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CABIN AIR QUALITY

HEARING

BEFORE THE

SUBCOMMITTEE ON AVIATION

OF THE

COMMITTEE ON COMMERCE, SCIENCE,
AND TRANSPORTATION
UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

FIRST SESSION

ON

S. 197

TO DIRECT THE SECRETARY OF THE DEPARTMENT OF TRANSPORTATION TO CONDUCT AN INDEPENDENT STUDY TO DETERMINE THE ADEQUACY OF CERTAIN INDUSTRY PRACTICES AND FEDERAL AVIATION ADMINISTRATION RULES AND REGULATIONS, AND FOR OTHER PURPOSES

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CABIN AIR QUALITY

WEDNESDAY, NOVEMBER 9, 1983

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
SUBCOMMITTEE ON AVIATION,
Washington, D.C.

The subcommittee met, pursuant to notice at 9:34 a.m. in room SR-253, Russell Senate Office Building, Hon. Paul Trible presiding.

Staff members assigned to this hearing: Chuck Doyle, staff counsel, and Steve Palmer, minority staff counsel.

OPENING STATEMENT BY SENATOR TRIBLE

Senator TRIBLE. Good morning. The Aviation Subcommittee will come to order. We have convened this hearing to explore an issue relating to the health and safety of the crew and passengers on commercial aircraft.

For several years we have heard about health problems stemming from prolonged exposure to ozone in very high altitude flights. In addition, the need of the air carriers to conserve fuel has led many of them to reduce the flow of fresh air through the cabin area.

On January 26 of this year Senator Inouye introduced S. 197. This measure would direct the Secretary of the Department of Transportation to conduct an independent study to review the adequacy of industry practices and FAA rules and regulations which set the minimum standards for air quality in commercial aircraft. Based on the oral testimony presented today and submissions to the record, the subcommittee will consider whether to recommend further action on this bill.

The subcommittee is very interested in the health and safety of air travelers and flight personnel. I appreciate the interest Senator Inouye has shown on this issue and his leadership and he will be joining us momentarily.

I feel the hearing today will contribute to our understanding and to the understanding of the industry and to a better appreciation of the needs of the traveling public.

At this point I will yield to my distinguished colleague from Hawaii.

OPENING STATEMENT BY SENATOR INOUYE

Senator INOUYE. I wish to thank the distinguished chairwoman from Kansas for her leadership, interest, and concern in the issues currently before this subcommittee and for her decision to hold further hearings on airline cabin safety and health standards.

As this subcommittee knows, the subject matter of today's hearing and the provisions of S. 197 are identical to the subject matter and provisions of S. 1770 previously discussed by this subcommittee on May 20, 1982. At those hearings I explained my concern about the FAA's neglect in the field of aviation safety and health, about reports of industry practices that subject unsuspecting passengers to traveling conditions that may jeopardize their health; and about reports of unhealthy working conditions for tens of thousands of flight attendents that have not been investigated or corrected for years.

I must concede that I have a personal interest in this legislation. I fly to and from Hawaii 20 times every year and spend approximately 23 days in airplanes. I am certain that most Members of the Congress have a similar personal interest in promoting healthful cabin air environments.

However, this is not a personal political crusade. Cabin air quality is a major consumer issue and a major labor/health issue. Last year, scheduled air carriers served 300 million passengers, millions of whom are frequent flyers like me. Public consciousness of a developing health problem is rapidly growing, and I would like to note that several health organizations will be submitting statements in support of the bill for the hearing record.

Carriers employ approximately 51,000 flight attendants, and this number is growing as the aviation industry recovers from our economic depression. In addition, there are uncounted tens of thousands of former flight attendants who have been exposed to the same kinds of cabin conditions that are the subject of today's hearings.

I would like to make another important point. My bill is closely related to fire safety, but it also raises discrete issues. Even if firefighting equipment were vastly improved, the consumer and health issues would remain. I intend to introduce a comprehensive air safety bill in the near future, but at the present time I would like to focus on this bill.

At the initial hearing, the American Transport Association, the Aerospace Industries Association, and the FAA consistently denied knowledge of any existing safety and health problems. They clearly stated the needlessness of a study like the one called for by this bill. Yet, by the end of today's hearing, I am confident that there will be overwhelming evidence that a problem does, indeed, exist and that there is a compelling need for a comprehensive study. To my knowledge, only the FAA and carriers continue to resist the idea of an independent investigation.

I regret to inform this subcommittee that in the 17 months since its initial hearings nothing has occurred that substantiates the FAA and industry denials of any existing problems. Quite the contrary. My suspicions have been confirmed, and as a matter of fact, the problems may be far greater than ever I suspected. It is our objective here today not only to ascertain problems and deficiencies but also to determine the magnitude and implications of the problems we know of and to set about a course of immediate and corrective action.

Aviation affect all of us in our daily lives either directly or indirectly. The civil air transport system in this country is now comprised of approximately 4,000 aircraft which fly almost 300 million passengers annually. We still marvel at aerospace technology and take for granted that the ordinary amenities of flight such as fresh air ventilation, contamination control, fire extinguishing equipment, toxic fume protection, etc., are attended to in an appropriate and satisfactory manner such as we are accustomed to in our daily nonaviation environment. Unfortunately, in some cases this is not so.

Unquestionably, the technological marvels seem to never cease. The planes become bigger and faster. But along the road of this explosive technological growth, it seems that we have forgotten to attend to the mundane but vitally important aspects of air travel that are detailed in S. 197. Some of the Federal aviation regulations now on the books date back to the piston-age era and are totally irrelevant and outdated for our modern aviation transport system.

Subsequent to the May 20 hearings, I continued my inquiry into the airline cabin safety and health standards. Contrary to the Administrator of the FAA and his statement that the study proposed by my bill is unnecessary, my files are filled with evidence of problems, and we shall be hearing more about this from the witnesses today. In addition, I have received impressive and convincing statements of support which I shall insert in the record.

The genesis of this bill was a denial by the FAA of a petition for rulemaking which sought to establish some fresh air ventilation standards during normal and emergency conditions. The FAA has repeatedly relied on this denial as a basis for the FAA position opposing the study called for in my bill. With the information on hand, I can clearly state that the FAA handling of the petition was flawed, and the denial of the petition in light of the facts appears unjustified. Therefore, any future reliance by the FAA on their previous denial of the peititon by Zenex Corp. does not, in my mind, justify its stand.

In the course of last year's hearings, Mr. Lynn Helms, Administrator of the FAA, made the following statement relevant to the predecessor bill to S. 197:

> In closing, I wish to reiterate that the FAA has thoroughly reviewed the issues raised by S. 1770, and I am satisfied that the current standards relating to the issues are adequate. We do not support the independent study called for by the bill and, in our view, the performance of such a study would call for the needless expenditure of funds at a time when fiscal prudence is clearly called for in every activity we undertake.

The Administrator's statement are, in light of common knowledge and facts, extremely disappointing and erroneous. By way of explanation and to illustrate the magnitude of some of the problems, let me explain the following:

Although it is commonly believed by many people that the air-conditioning system on an aircraft is merely installed for the sake of comfort, this is not true. The fact is that the air-conditioning system of an aircraft is a sophisticated life support system, without which we would be unable to survive jet travel or even, for that matter, be enclosed in an aircraft cabin on the ground. For safety purposes there are at least two, and on larger planes three, life support systems, or air-conditioning packs as they are known. Commonly these are operated simultaneously. In the event of a malfunction, crews and passengers can survive on only one. The cockpit crew has additional systems at their disposal. Among the additional systems for the cockpit crew are a smoke evacuation system and a toxic fume protective breathing system, both of which are required by regulation. These systems are life support and life saving systems for use by cockpit crews during emergency conditions. In the case of the Air Canada disaster last summer, it has been alleged that the cockpit crew donned their additional life safety equipment and, believe it or not, turned off the only packs available to the cabin crew and passengers to contain the fire. I do not fault the crew, which had to reduce fuel to the fire, but this kind of incident underscores the fragility of the cabin air support systems and the terrible dilemmas which face airlines in emergency conditions.

I know these charges must shock us, and one can only think that in the event of an emergency when we travel we may faced with the same circumstance, that is, the cockpit crew dons their protective breathing equipment while cutting off our life support system. For the Administrator of the FAA to say that there are no problems and that there is no need to study these matters is, under the circumstances, most surprising. I cite this allegation to emphasize that the air-conditioning packs are the basis of all of these problems as they relate to healthy traveling conditions and to emergencies.

I could cite numerous other problems of greater and lesser importance than this foregoing example, but I think a number of our witnesses will provide us with additional information. This committee wants to get to the bottom of the problems, and we want to correct them. I hope to do it with the cooperation of the FAA and the air carriers.

Our country is still the leader in the aviation and aerospace industry and I, for one, intend to keep it that way. We will not be able to maintain our leadership by sticking our heads in the sand and hiding behind unreliable figures or safety records. For the FAA to invoke the argument that it is trying to reduce regulations is unacceptable. Obviously, regulations which no longer have any meaningful value should be eliminated. However, based on the precedents we have everywhere in our society, it would appear prudent, indeed, imperative to establish certain reliable safety and health standards.

For instance, how should we operate a life support system to best protect the welfare of air travelers?

What are the appropriate standards to maintain a healthy and safe environment? This is no different than subjecting ourselves to the safety standards and regulations we have established for automobiles, that is, speed limits and stop lights. I can find no reason for the FAA to exempt itself and the industry it governs from these basic and fundamental considerations.

We have to take a strong stand in the public interest. It has been my hope that the FAA will cooperate. Even the most recent proposals by the FAA in the aftermath of the Air Canada disaster fall far short of what is needed. We still have not heard from the agency on whether it would propose rules to require airlines to furnish meaningful fire extinguishing equipment on board aircraft or to increase toxic fume protection. Both of these actions are necessary for meaningful safety.

Madame Chairwoman, I digress slightly from the major focus of my legislation, which is about cabin air quality generally, to talk about air safety because I feel very strongly about the subject. I know that is will be the subject of later hearings. The subject is too vast to raise now except in the most cursory fashion, but I mention it because it is related to the subject at hand, namely, the willingness of the FAA and carriers to engage in a meaningful attack on this problem.

I would like to assure my friends in the aviation industry that my legislation is not intended to impose costly new burdens on them. Last year we heard that the improvements in air conditioning and ventilation would cost only a few cents per passenger. Such an investment is worth the expenditure, and I think that airlines should exploit their health and safety practices in their advertising. As a passenger, I can think of no better reasons to choose one of many competing airlines than their records and practices in this crucial area.

Finally, I would like to express my understanding of the dilemma in which many companies find themselves. Caught in the price squeeze caused in part by airline deregulation, they now must count every dime. But the answer is not to skimp on safety and health but rather insure that all airline—scheduled and non-scheduled—meet adequate standards. Those who surpass them deserve to boast to the general public about their commitment to their employees' and passengers' welfare. Those that do not meet them deserve to be censured severely by the CAB and FAA. My door is open to the industry just as it is to the flight attendants and consumer and health organizations to discuss this matter more fully.

Senator Kassebaum, again, I would like to thank you for this hearing and this opportunity to discuss this important issue.

[The bill follows:]

98TH CONGRESS
1ST SESSION

S. 197

To direct the Secretary of the Department of Transportation to conduct an independent study to determine the adequacy of certain industry practices and Federal Aviation Administration rules and regulations, and for other purposes.

IN THE SENATE OF THE UNITED STATES

JANUARY 26 (legislative day, JANUARY 25), 1983

Mr. INOUYE introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

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A BILL

To direct the Secretary of the Department of Transportation to conduct an independent study to determine the adequacy of certain industry practices and Federal Aviation Administration rules and regulations, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) the Secretary of the Department of Transportation shall, in the interest of health and safety, and in the interest of promoting and maintaining a superior United States aviation industry, direct the Administrator of the Federal Aviation Administration to conduct an independent study to determine whether industry practices and standards, Federal

Aviation Administration rules, regulations, and minimum standards are nondiscriminatory and at least in conformance and parity with nonaviation standards, practices, and regulations (including de facto circumstances) concerning the following, for all passengers and crew aboard civil aircraft. Special and objective considerations to be given to both positive and negative aspects of the uniqueness of the aviation environment:

(1) quantity of fresh air per occupant and overall quality of air on board;

(2) quantity and quality of humidification;

(3) air contamination limits;

(4) emergency breathing equipment, including toxic fume-protective breathing equipment;

(5) measures, procedures, and capabilities for extinguishing fires and the removal of smoke and toxic fumes within safe pressurization limits;

(6)(a) safe pressurization, considering the broad range of cardiopulmonary health of the traveling public; dissemination of information to the medical profession and the general public of current pressurization limits and practices to assure valid medical advice concerning the health effects of air travel; and

(b) collection and dissemination by the aviation industry, the Federal Aviation Administration, and/or any other private or governmental organization of a data base of medical statistics relating to air travel, in an effort to assess the adequacy of aircraft systems, design, regulations, standards and practices from a health and safety standpoint, and for the purpose of issuing Federal Aviation Administration administrative advisory circulars and airworthiness directives to correct any deficiencies disclosed.

(b) The Administrator of the Federal Aviation Administration shall complete the study required by subsection (a) and submit a report of the results thereof to Congress not later than six months after the date of enactment of this Act.

(c) In conducting the study required by subsection (a)(1) through (6)(b) the Administrator shall utilize all available studies, recommendations, data, current technology, and state of the art which are relevant to such study.

(d) There are authorized to be appropriated $500,000 for the fiscal year commencing October 1, 1983 to carry out the study authorized by this Act.

Senator **Trible**. Thank you, Senator, for your statement and your leadership in this area.

We will call as our first witness Dr. Craig Beard, Director, Office of Airworthiness, Federal Aviation Administration.

STATEMENT OF CRAIG BEARD, DIRECTOR, OFFICE OF AIRWORTHINESS, FEDERAL AVIATION ADMINISTRATION, ACCOMPANIED BY DR. JON L. JORDAN, DEPUTY FEDERAL AIR SURGEON; AND TOM McSWEENY, ACTING MANAGER, AIRCRAFT ENGINEERING DIVISION

Mr. **Beard**. Thank you very much, Mr. Chairman.

I am Craig Beard, Director of Airworthiness for the Federal Aviation Administration. On my right I have with me Dr. Jon Jordan, the FAA's Deputy Federal Air Surgeon; and on my left Mr. Tom McSweeny, the acting manager of the Aircraft Engineering Division at the FAA.

We are pleased to appear before the subcommittee again on the subject of air quality standards of aircraft.

When we appeared before the subcommittee a year ago last May to offer the FAA's views concerning S. 1770, which is identical to S. 197, we indicated our belief that the ventilation systems of transport aircraft are fully adequate. We continue in that view.

As you may recall, FAA regulations require that passenger and crew compartments must be suitably ventilated and fuel fumes may not be present. The regulations also specify a maximum carbon monoxide concentration of 1 part in 20,000 parts of air.

While ventilation, as might be expected, varies to some extent from one type of aircraft to another, aircraft flow rates exceed the guidance material for passenger transportation aircraft developed by the American Society of Heating, Refrigeration and Air Conditioning Engineers. The flow rates of aircraft compare favorably with recommended standards for nonaviation environments.

With respect to the subcommittee's interest in focusing on the possible transmission of airborne bacteria in an aircraft environment, we are not aware of any problem unique to aircraft which should be accommodated by changes in ventilation requirements. In fact, we are only aware of one documented case in which influenza was spread in an aircraft environment, and that occurred, as the subcommittee is aware, under a set of unusual conditions unrelated to the adequacy of the ventilation system.

The subcommittee is also interested in looking into the issue of venting smoke from an aircraft cabin in the event of a fire. As indicated to you a year ago last May, the FAA has an ongoing research effort in this area. Our research program is designed to develop a smoke generation and measurement technique which can be used for testing of smoke evacuation of aircraft cabins.

The test methodology being developed by the FAA will enable us to more realistically simulate smoke characteristics and to accurately measure smoke venting from a cabin environment. This will permit the FAA and industry to better evaluate the effectiveness of ventilation and smoke evacuation systems and to work on optimizing their design. We expect this research program to be completed this spring.

The subcommittee has also expressed interest in cigarette smoking aboard commercial aircraft. In 1971 a study of the health aspects of smoking in transport aircraft was conducted jointly by the FAA and the Public Health Service. The purpose of the study was to define the levels of certain combustion byproducts of tobacco produced by passengers' smoking, to determine passengers' subjective reaction to tobacco smoke, and to obtain passenger opinion on the need for regulatory change regarding the control of smoking in commercial passenger aircraft.

The study involved the collection of samples to determine the environmental exposure levels to carbon monoxide, particulate matters, polynuclear hydrocarbons, ammonia, and ozone. The environmental sampling revealed very low levels of each contaminant measured. In fact, they were much lower than those recommended in occupational and environmental air quality standards.

These combustion products were judged not to represent a hazard to the nonsmoking passengers based upon environmental levels and expected dosage response relationships of contaminants. A significant proportion of the nonsmokers, however, did indicate that they were bothered by tobacco smoke and suggested that corrective action be taken, such as segregating smokers from nonsmokers. Over 70 percent of the nonsmokers with a history of respiratory conditions expressed annoyance by tobacco smoke.

Research continues to be performed on the health effects of passive smoking. To date there is no evidence of an increased incidence of cardiovascular disease in passive smokers. There has been some evidence of physiological pulmonary changes in passive smokers, but this research has been questioned by others.

Research in long-term exposure such as in nonsmoking wives of heavy smokers, may indicate that the wives have a higher risk of lung cancer.

I am advised that based on these and other studies it is the FAA's view that the casual exposure to secondhand cigarette smoke in a reasonably ventilated environment is not expected to have any relationship to cardiovascular or pulmonary disease causation.

The possibility of passengers' annoyance to smoke is, of course, a different issue which, I might add, is currently being explored in a rulemaking action by the Civil Aeronautics Board. Therefore, from a health perspective we have seen no need to require changes in aircraft ventilation systems.

That completes my prepared statement, Mr. Chairman, and we would be very pleased to respond to questions from you and the committee.

Senator Trible: Thank you, Mr. Beard.

I understand the FAA has set standards for ozone levels in aircraft cabins, as you have testified here today. But is it also a fact that no actual monitoring of these levels takes place?

Mr. **Beard**. Sir, I do not believe that is the fact. We did monitor it for a time period. I cannot answer your question on just exactly what our level of monitoring is at this time, but I can certainly answer that question for the record.

Senator **Trible**. Well, I wish you would submit that information. We would want to know precisely what monitoring system is in place and when and how frequently these tests are conducted. Obviously a standard cannot be of any value if it is not being met, and that requires some monitoring on the part of FAA.

Mr. **Beard**. If I might add, Mr. Chairman, probably one of the most effective ways of controlling is to insure that the design is such that you do not put the ozone in the cabin to begin with, and this gets into equipment design which will have a significant control, and they cannot change that equipment without FAA approval.

So we do have control there, but we will get the question answered for the record.

Senator **Trible**. If you would provide that information for the record, I think it would be very helpful for us, and I thank you.

[The information follows:]

The FAA conducted a cabin ozone monitoring program on commercial aircraft in 1978 and 1979. This provided information about ozone concentration for use in the rulemaking process which established cabin ozone concentration standards.

As described in the discussion to the regulation, compliance with the prescribed ozone concentration limits need not be demonstrated by flight crew monitoring on each aircraft. FAA Advisory Circular 120-38, dated October 10, 1980, provided guidance concerning acceptable means to demonstrate compliance. An air carrier may select one of the methods defined on page 3 of the Advisory Circular, and demonstrate compliance accordingly. Compliance by specific aircraft type has generally been made as follows:

1. Operators of most wide-body aircraft (747, DC-10, and L-1011) have selected the use of statistical analysis along with the installation of catalytic ozone-destroying filters to reduce the amount of atmospheric ozone introduced into the cabin during flight.
2. Operators of most short-range aircraft (737, DC-9) have selected the use of statistical analysis to show that their flight plans will not expose the aircraft to high concentrations of atmospheric ozone, so that catalytic converters or filters are not needed.
3. Some operators of medium-range aircraft (727) have adopted altitude restrictions, and have shown that such flight planning will keep those aircraft away from regions of high atmospheric ozone concentrations. For example, based on our historic records of atmospheric ozone concentrations, 727 aircraft will comply with the specified limits for flights below 47½ degrees N latitude at flight altitudes of 39,000 feet and below. Above 47½ degrees N, lower altitudes must be used during the months of February through June each year, because of the higher concentrations of ozone appearing naturally during those months at those latitudes.

These methods for protecting aircraft passengers from exposure to an unacceptable level of ozone concentration have alleviated the high-altitude ozone problem since further complaints due to the ozone exposure have not been recieved.

Senator **Trible**. Do you have any information on the extent to which air carriers are operating less than the full ventilating system on their aircraft today?

Mr. **Beard**. We do permit operators to dispatch with air-conditioning packs shut down. However, we still have the pressurization requirements which really drive the ventilation issue a lot more than ventilation itself.

The aircraft must be able to maintain 8,000 feet cabin altitude irrespective of the altitude that the aircraft is flying and it must be able to maintain 15,000 feet with a failure in the ventilation pack system, so they would not be able to dispatch without sufficient packs operating to maintain those requirements.

Senator **Trible**. Do you have any indication of how the ventilation system does affect these problems, however? In your response it seems that you minimized the impact and I wonder if there is any objective evidence as to how these factors play in the total equation.

Mr. BEARD. I guess what I am saying is we have seen no evidence to indicate that permitting them to dispatch with a ventilation pack inoperative or shut down has created a ventilation problem.

Senator TRIBLE. And on what do you base that judgment?

Mr. BEARD. On the lack of any evidence that there is a problem, any problem in the aircraft. May I misunderstand your question, Mr. Chairman.

Senator TRIBLE. Well, we can pursue that and I am sure that Senator Inouye will want to ask a series of questions as well. So let us move on to one final point and then I will yield to my colleague from Hawaii.

Statements by flight attendants indicate there are many complaints today about dizziness, nausea, chest pains, and other physical problems. They suggest that these could be caused by the wide variety of toxic contaminants which are recirculated through the cabin. Has the FAA done any studies to determine if these toxic contaminants, which do not appear to be a problem at ground level, may indeed be a health hazard at higher altitudes?

Dr. JORDAN. Yes, Mr. Chairman.

Senator TRIBLE. Tell us your name for the record.

Dr. JORDAN. My name is Dr. Jon Jordan. I am the Deputy Federal Air Surgeon with the Federal Aviation Administration.

Senator TRIBLE. Thank you.

Dr. JORDAN. Yes, we did a fairly extensive study in 1971. It was directed principally at the question regarding smoking onboard aircraft and the effect of the metabolites of the smoking process, the burning process.

The study that we did at that time revealed that there were minimal contaminants in the air, especially in reference to cigarette smoking, and none of these posed a health hazard problem to either the passengers or crew.

Senator TRIBLE. What other kind of contaminants might be present on a regular basis?

Dr. JORDAN. Well, certainly various particles of hydrocarbons, ammonia, carbon monoxide—that sort of thing.

Senator TRIBLE. Did your study extend to those kinds of substances?

Dr. JORDAN. Yes, it did.

Senator TRIBLE. All right. Thank you, Dr. Jordan.

Senator Inouye.

Senator INOUYE. I would like to follow up on your question, Mr. Chairman, on that 1971 study that you referred to. I believe you cite this as an example to reassure us of the commitment to health problems. Last year during the hearings on S. 1770, Dr. John Kashishian—are you aware of Dr. John Kashishian?

Dr. JORDAN. Yes, I know Dr. Kashishian quite well.

Senator INOUYE I believe he served on your task force.

Dr. JORDAN. He was invited and I think took one trip with the task force.

Senator INOUYE. He said this, and this is from the testimony:

I served aboard an ad hoc task force of the ill-fated 1971 report that never surfaced. I was one of the senior medical officers. Unfortunately, the results were flawed because the equipment was not working well, so the report never came out.

Why do you cite the results of this unpublished and admittedly flawed document?

Dr. JORDAN. Yes, Senator. The report was, as a matter of fact, published, and we did submit a copy of that report to the subcommittee at the time of or subsequent to our last testimony.

Senator INOUYE. When was it published?

Dr. JORDAN. It was published in 1971 by the Public Health Service.

Senator INOUYE. Then you disagree with the doctor here?

Dr. JORDAN. Absolutely.

Senator INOUYE. If it is true—and I am inclined to believe the validity of findings by researchers at the Center for Disease Control—the Center maintains that the disease transmission rate in an aircraft can be as high as 72 percent. That is on an aircraft with 450 passengers. More than 300 can be infected from one single individual.

Would you agree with that?

Dr. JORDAN. I have no way of challenging that. It would depend upon the circumstances, Senator. In Mr. Beard's statement, of course, he referenced the incident involving an aircraft that was grounded in Alaska for a period of about 3 hours. In that particular aircraft there was an individual onboard who had influenza and spread that to about 70 percent of the other passengers.

The problem is that the entire aircraft system was shut down and as a result the individuals were in a closed space without any kind of free flow of air, and as a result a significant number of those individuals ended up with influenza.

I think it is possible, of course, depending upon the given circumstances, that on aircraft in flight, an individual who has a highly infectious disorder could spread this to other passengers. Whether it would be possible to spread it to 72 percent of the other passengers I would think would be highly dependent upon the movement of the individual about the cabin.

Senator INOUYE. Would it be dangerous if it spread to 10 percent of the passengers?

Dr. JORDAN. I would agree that you certainly do not want communicable disease as a problem, but I think you know that sitting in any environment where there are a number of people you are subjected to that kind of a hazard, whether it is a bus——

Senator INOUYE. Is there any validity to the suggestion that over 90 percent of the humidity which is provided in the air system onboard a flying aircraft is provided by perspiration and breath?

Dr. JORDAN. I think a great deal of the humidity would be provided by perspiration and breath, but I do not see that as a health hazard.

Senator INOUYE. If we can be breathing in somebody's breath, can we breathe in someone else's bacteria or a virus?

Dr. JORDAN. Bacteria, by and large, are transmitted through dust particles rather than loss of fluids through sweating or normal breathing processes. You, of course, can transmit bacteria by coughing or sneezing on someone. The water droplets can be a major source of the problem.

Senator **Inouye**. What is being done to cope with the spreading of communicable diseases aboard flying aircraft?

Dr. **Jordan**. We have no indication that there is a serious problem, Senator. We have had absolutely no feedback in this area, with the exception of this one incident involving the airplane in Alaska.

Senator **Inouye**. The airplane in Alaska was cited because all of the passengers came from one village. Now when I fly in from Hawaii into Los Angeles and when passengers get out they scatter to all parts of the Nation. Fifty percent of us could have had the flu, but very few of us would connect that to the flight.

Have we ever done any research?

Dr. **Jordan**. We have done no research, and as far as I know no other organization has done research.

Senator **Inouye**. Without research you are assuring us that everything is safe.

Dr. **Jordan**. Based on what information we do have or the absence of information I see no reason to pursue it extensively.

Mr. **Beard**. Senator, I believe a more accurate statement would be that we do not see the aircraft environment to be any more hazardous than the environment that people find themselves in in restaurants and theaters and office buildings, in normal work places. I do not believe we have the research or would even attempt to say that you might not catch flu from somebody in an aircraft.

I think what we are saying is we do not see it to be a special, unique aviation problem and we do not believe the passenger in a transport category aircraft is subjecting himself or herself to a level of health risk any higher than what they subject themselves to in their day-in and day-out routine in life.

Senator **Inouye**. What is the practice aboard, say, the wide-bodied planes? I have been told that you have three packs on board these planes.

Mr. **Beard**. Yes, three packs is typical, and they may dispatch with a pack down. I might hasten to point out that there are many systems in the aircraft where the manufacturer at the choice of their customer, the airlines, order the aircraft and design the aircraft with redundant systems, systems that exceed what is required by the regulations or systems which exceed what is required by passenger comfort simply so they can dispatch these aircraft when they are having a mechanical problem.

Dispatch reliability is a very important factor in the economic viability of a carrier, and they have learned years ago to put more systems aboard the aircraft—and I am speaking not only of the ventilation systems but other systems—than is required so they can dispatch with systems inoperative. And that is true in the ventilation systems.

Senator **Inouye**. Actually, the air pack is a life support system, is it not? That is the only thing we have there.

Mr. **Beard**. It is a life support system. If you have a total pressurization failure, of course, you do have the oxygen masks that drop down that substitute for it. But the basic air pack is to provide the pressurization and it is a life support system and there is redundancy in that system.

Senator **Inouye**. From the FAA's standpoint, how many packs are supposed to be in operation in flight?

Mr. **Beard**. Whatever it takes to maintain a cabin altitude of no more than 8,000 feet irrespective of the altitude the airplane is flying at, and enough packs to where they have the ability if they are flying above 25,000 feet to be able to maintain 15,000 feet with failure of the pack systems.

Senator **Inouye**. Would one pack be enough?

Mr. **Beard**. Depending upon the altitude, it could be enough, yes.

Senator **Inouye**. What altitude is that?

Mr. **Beard**. If you were planning to cruise below 25,000 feet and would have the ability to reach 15,000 feet before the cabin reached that altitude if you did have a pack failure, you could dispatch with one pack.

Senator **Inouye**. As a passenger, how many packs do you want operating?

Mr. **Beard**. Well, Senator——

Senator **Inouye**. We are not talking about just surviving. You are a passenger. How many packs do you want?

Mr. **Beard**. I would not want any more than those that I just cited to you as a passenger, and I am a passenger.

Senator **Inouye**. One would be enough?

Mr. **Beard**. One would be enough if under the conditions of dispatch not to go over 25,000 feet and a demonstrated capability of being able to descend and maintain a cabin altitude of no greater than 15,000 feet should that pack fail. I would feel perfectly safe.

Senator **Inouye**. When there is a smoke alarm, what happens with the packs? Are they operating?

Mr. **Beard**. I do not believe—we have rulemaking to require smoke alarms in lavatories in the making at this moment, but at this point the only fire alarms that we have required would be engine fires and it would not be related to this.

Senator **Inouye**. Let us say there is an engine fire. What happens to the packs?

Mr. **Beard**. That engine would be shut down and it probably would not affect the packs.

Senator **Inouye**. The packs are still operating?

Mr. **Beard**. Yes.

Senator **Inouye**. Is that the regulation?

Mr. **Beard**. You must be able to show that you can maintain at least a 15,000-foot cabin altitude with any failure in the system, and if the engines shut down it would also effect a shutdown to the pack and this would be one of the failures that the manufacturer would have to demonstrate compliance with this regulation on.

Senator **Inouye**. Why did Air Canada turn off the packs?

Mr. **Beard**. I wish I knew that; I wish I knew that.

Senator **Inouye**. I can understand why the pilot must have the best air possible. Why not for the crew and the rest of the passengers?

Mr. **Beard**. I have a hard time believing that the crew shut off the packs to reserve air for themselves, and I think that this is still very open in the accident investigation stage, and my comments would be purely speculation, which would probably have Chairman Burnett very angry at me for speculating on probable cause or speculating as to why the crew did things.

But I have a hard time believing that they would have shut down those packs to preserve the air for themselves.

Senator **Inouye**. Let us take a safe plane that is flying. Does the pilot get the same air that I get?

Mr. **Beard**. Basically yes.

Senator **Inouye**. Oh, come on. Every witness has testified that there is a special system in the cockpit.

Mr. **Beard**. You could say each seat has a special system. I believe the same air, though, is circulated, that is recirculated through the aircraft and it is ducted from the packs to various locations in the aircraft, and there may be ducting dedicated to the passenger, but there is probably ducting dedicated to the crew and in various locations throughout the cabin of the airplane.

Senator **Inouye**. That is the understanding of the FAA, that the pilot breathes the same air that I breathe?

Mr. **Beard**. That the pilot is dependent upon the same pack ventilation system to obtain that air, and when the air leaves that it goes back through the ventilation system and that same particle of air may end up anywhere in the airplane after that is over.

Senator **Inouye**. He gets just the same amount of oxygen, the same flow?

Mr. **Beard**. That is correct, sir.

Senator **Inouye**. Well, we have been told that pilots receive 10 to 20 times more fresh air than the cabin crew and passengers per person per minute. Is that testimony false?

Mr. **Beard**. Let me ask Mr. Tom McSweeny to answer that. I believe he has some more detailed information.

Mr. **McSweeny**. Tom McSweeny, acting manager, aircraft engineering Division.

I believe that maybe what Craig was referring to is the air itself, and that air does come from the same plenum that the air entering the cabin comes from. You are correct in that the flow is higher in the cockpit than it is in the rest of the cabin.

Senator **Inouye**. Why should it be higher in the cockpit? You will have to enlighten us. Why should the pilot get more than the flight attendant or the passenger?

Mr. **McSweeny**. There are a couple of reasons for that, and it goes back to the history of the rulemaking when the rule was originally issued. That certainly is to allow the pilot, who must land the aircraft safely if something should happen, to basically get the best chance he or she has of doing that.

The higher air flow would help dissipate any smoke that would come into the cabin, into the cockpit. Also, it helps in the comfort of the pilot and copilot on long flights. And third, there is a lot of avionics in the cockpit which the air is used to cool, and it is my belief that in some of the newer aircraft some recirculating air is used to cool the avionics and has resulted in a reduction a little bit of the rest of the flow into the pilot compartment.

Senator **Inouye**. You spoke of smoke dissipation. Is the air flow on only when smoke is present?

Mr. **McSweeny**. No, it is not.

Senator INOUYE. Then if it is going to make it comfortable for the pilot and safe for the pilot, why not us?

Mr. MCSWEENY. I think it bacically is a realization that the pilot is the one responsible for the flight of the aircraft, is required to be as alert as possible in case of sudden events such as could happen on a transcontinental or transoceanic flight.

Senator INOUYE. But not the crew?

Mr. MCSWEENY. You are referring now to the flight attendants?

Senator INOUYE. The crew in the back—the flight attendants. They get the same thing I get.

Mr. MCSWEENY. I think the point we are trying to make is that it is not unhealthy in the cabin and that the air flow in the cabin is certainly enough in comparison with other types of similiar areas that people might be subjected to, including the flight attendants.

It was only the realization that in the cockpit we felt a need to go a little bit beyond that. I do not think there is any relationship between the increased flow and any additional health benefit in our mind.

Senator INOUYE. When did the FAA come to the conclusion that smoke was hazardous?

Dr. JORDAN. What type of smoke, Senator?

Senator INOUYE. When a plane is burning, a seat is burning, carpet is burning, drapes are burning.

Dr. JORDAN. As far as toxicity of smoke in general is concerned, we have known, of course, for years and years.

Senator INOUYE. Have we done anything about it?

Dr. JORDAN. Yes. We have researched the area to determine the combustion products.

Senator INOUYE. Well, I notice that the pilot has a special smoke mask because he has to land the plane. But what about the flight attendant who has to help us or the passengers themselves? Do they not deserve smoke masks?

Dr. JORDAN. In response to that, Senator, there are certain problems with smoke masks, certainly for the passengers. We have done a number of studies at our medical institute in Oklahoma City regarding problems associated with the use of some sort of a device that an individual would put over his or her head that conceivably might allow them to exit the aircraft in the event of smoke or fire.

The problems with that device are that persons unfamiliar with donning techniques and actual practical experience in donning the device are likely to run into some difficulty. If you don the device too early in the process then you are going to run out of oxygen within the mask, depending, of course, on the type of mask that is used. I am speaking principally of one that is not connected to the oxygen supply within the aircraft.

Senator INOUYE. So we do not do anything about it?

Dr. JORDAN. Well, this is an area that the Administrator has indicated he intends to look into again.

Senator INOUYE. This committee has been told that the bacteria colony count could be expected, at worst, to be approximately two colonies if tested in this room. At the same time, testimony presented shows bacteria colony count on board aircraft range up to 150, sometimes 250 colonies.

It has been said that as you decrease fresh air ventilation contamination on board will rise. Is this correct?

Dr. **Jordan**. I cannot personally document that kind of a study. The agency has not done studies to culture bacteria on board aircraft. I think in any circumstance where you get a large number of people in confined spaces, however, and depending on the time of the year and whether the individuals are carrying harmful bacteria that you would find the same results.

Now in this particular room where there is a fairly sparse population of individuals per cubic foot, you would certainly expect the transmission of bacteria to be less than it would be in an aircraft that is completely filled with individuals.

Senator **Inouye**. Well, as the testimony said, at worst it would be 2 and on aircraft at least 150. That does not concern you?

Dr. **Jordan**. Well, again, I think you have to look at relative factors—what is it that is special about the aircraft environment other than the fact that there are a fairly substantial number of people per square foot.

Senator **Inouye**. What would it cost to provide smoke masks and a better ventilating system?

Mr. **Beard**. Senator, I believe this is part of what we are going to be looking at again in the study that the Administrator promised to the House subcommittee.

Senator **Inouye**. Is that the prime concern—cost?

Mr. **Beard**. No, sir, I do not believe it is.

As I testified a year ago, one of my prime concerns—and I, too, travel a lot and I watch people—is their inattentiveness on briefings on even how to use simple oxygen masks. If you were to attempt to evacuate people from a burning aircraft who were for the first time trying to figure out how to pull one of these bags over their heads with the various umbilical cords running this way and that, I am concerned that we would probably lose more people entangled in this.

Even with life vests they teach you to not inflate them until you leave the aircraft. I am really concerned that it would take away from or it would distract from the item of paramount importance, and that is to move the people out of the aircraft. However, I do agree with the Administrator that it does warrant another look-see and we certainly will be doing that.

I think the only place the cost comes in is we feel we have an obligation to try to accurately assess the safety benefits of any of our proposals and accurately assess the cost to assure that we have not driven the cost of air transportation out of the reach of the common traveler.

Senator **Inouye**. It has been suggested that we could provide the best smoke mask possible and an improved pack system, and it may cost something like 50 cents per passenger. After all, we have 300 million passengers per year. Is that too heavy a load, to cut down on one hors d'oeuvre?

Mr. **Beard**. I would not wear a smoke mask if somebody paid me 50 cents. I think my concern with smoke masks is it may have a negative impact on safety, not that it costs too much.

To answer the question, if the number 50 cents is valid, that is a pretty low price if is does in fact improve the safety that much.

Senator **Inouye**. You said you would not wear a smoke mask even if they paid you, and yet your agency reports that most of the deaths are smoke-caused.

Mr. **Beard**. I believe I would be putting my priority on leaving the aircraft, and I believe that a smoke mask in a typical smoke environment could actually impede my visibility and slow down my ability to get out of the aircraft. And if everybody else in the airplane was fumbling around with them, it could have a significant safety impact.

I am expressing now my personal concern, and I believe that if we can develop smoke hoods that do not pose that threat, they need to be looked at again.

Senator **Inouye**. I have been told by pilots that it is easy to put on and easy to take off and there are no tubes to tangle your feet with.

Mr. **Beard**. If you look at the pilot's oxygen system, their smoke mask is simply generally a set of goggles that goes over the oxygen masks they wear. I cannot imagine that kind of a system being made available to passengers without them being tied to the very seat that they need to evacuate.

Senator **Inouye**. Mr. Chairman, I have many other questions, but I do not want to hold up the hearing too long. I would like to submit them, if I may.

Senator **Trible**. We would ask you to respond for the record, Mr. Beard, to the other questions submitted by Senators Inouye and other members of this panel.

Senator **Inouye**. I would like to thank the witnesses.

Senator **Trible**. We thank you for being here, Mr. Beard, Dr. Jordan, Mr. McSweeny.

Mr. **Beard**. Thank you very much, Mr. Chairman.

[The following information was subsequently received for the record:]

Questions of Senator Inouye and the Answers Thereto

Question. In 1976, there was a preliminary sample conducted by the Senior FAA Medical Examiner in Honolulu. The study shows that on a percentile basis, 6–7 out of every 100 air travelers with a certain ischemic heart disease die 3–4 days after air travel. The American Medical Association has also warned of similar problems for some travelers. Air travelers are dependent upon a life support system which can be operated in virtually any manner the airlines choose to.

I would like to know what the FAA has done and is doing to determine the magnitude of the dangers to travelers with heart problems by operation of life support systems.

What duty to ensure high fresh air standards, if any, do you believe the FAA has to travelers with cardio-pulmonary problems; flight attendants; non-smoking travelers.

Answer. The FAA has not had the opportunity to review the referenced study on air travelers with ischemic heart disease and is, therefore, unable to comment on the findings. We are aware, however, of the article "Medical Aspects of Transportation Aboard Commercial Aircraft" in the Journal of the American Medical Association (JAMA), dated February 19, 1982, Volume 247. This article addressed problems associated with cabin altitude and patients with cardiovascular or pulmonary disease, but did not address rate of ventilation or air standards.

The FAA has joined the American Medical Association in an effort to educate private physicians regarding cabin altitudes in commercial aircraft and possible effect on their patients with cardiovascular or pulmonary disease. In 1982, the FAA distributed reprints of the February 19, 1982, JAMA article and copies of the FAA Advisory Circular 91-8B, "Use of Oxygen by Aviation Pilots/Passengers," to all FAA Aviation Medical Examiners (copies enclosed).

The FAA aircraft certification process ensures fresh air standards for passengers on commercial aircraft. We are not aware of adverse health effects related to fresh air standards on travelers with cardio-pulmonary problems, flight attendants, or non-smoking travelers.

Question. In your statement, you say that the FAA requires that aircraft be suitably ventilated but then also go on to note that this requirement is "relative". What does the term really mean, if anything?

When was the regulation, FAR 121.219, adopted?

Does it take into account changes in aircraft design? Please explain.

Answer. The term "suitably ventilated" is a requirement which is intended to let aircraftt manufacturers and operators exercise initiative to demonstrate compliance with the latest industry accepted practices or state-of-the-art such as ASHRAE. The FAA believes that incorporating specific requirements in the regulations might inhibit development of systems which should meet current recommended standards. FAR 121.219 was recodified in 1965 from Civil Air Regulation 21.114 and does account for changes in aircraft design. For example, a modification for increasing ventilation made to the air conditioning and pressurization system and approved under the design regulations, FAR 25, would be acceptable under the operation regulations of FAR 121.

Question. During the hearings on S. 1770 in May 1982, we were advised by one frequent business traveler that he used equipment to measure a drastic drop of oxygen from 20.9 percent to 19 percent, the equivalent oxygen displacement by 7 percent air contamination. When, if at all, will the FAA investigate this oxygen reduction/displacement phenomenon?

Answer. The measurement by the "frequent business traveler" relates to cabin environments prior to takeoff. In addition to a concern regarding the accuracy of testing methods and equipment, it must be pointed out that a decrease in oxygen from 20.9 percent to 19 percent at ground level is not in itself deleterious.

The OSHA 19.5 percent oxygen safety limit, referenced in the letter of July 8, 1982, to Senator Inouye, is applicable to personnel entry into confined space containing known toxins that have not been measured. The "frequent business traveler" performing this measurement concluded that this oxygen displacement was secondary to hydrocarbons from fuel combustion by aircraft and other vehicle engines in the immediate area. In order to provide an acceptable cabin environment (e.g., air conditioning, no significant increase in carbon dioxide, etc.) outside air must be used. Unfortunately, many outside environments contain high concentrations of hydrocarbons secondary to combustion. Although these hydrocarbons are offensive from a sensory viewpoint, they are not believed to pose a significant health hazard. If this study were repeated on an urban freeway during "rush" hours, similar results would probably be obtained.

At this time, the FAA does not plan to investigate this oxygen reduction displacement/phenomenon because we have no evidence that it is deleterious to either the health of aircraft occupants or to aviation safety when the displacement is associated with non-toxic levels of hydrocarbons in the environment for short periods of time.

Question. We have been told, and we know by the FAA's previous testimony and that of others, that pilots receive 10-20 times more fresh air than the cabin crew and passengers do per persons per minute. There are no specific regulations controlling the minimum quantity of fresh air for the occupants of the passenger cabin. What are the reasons for not providing such standards since they relate to the health and safety of the occupants?

Answer. In 1952, Amendment 4b-6 of the Civil Air Regulations established a fresh air requirement of 10 cubic feet per minute (CFM) for each flight crew member not for health or personal safety reasons but to enable them to perform their duties without undue discomfort or fatigue. Although the requirement applicable to the passengers states that the aircraft must be "suitably ventilated", data submitted to the subcommittee in July 1982 shows that almost all airplanes, fully occupied, provide at least 10 CFM per passenger for the cabin. The 10 CFM requirement is greatly exceeded in the flight crew area because of additional considerations, such as ventilating electronic equipment under the flight deck, in combination with the low occupancy for that area (2 or 3). As the occupancy of an aircraft cabin is lowered, the fresh air per passenger would also approach the amount available per flight crew member.

Question. You say in your statement that the FAA believes that casual exposure to second-hand cigarette smoke is not expected to have any relation to cardiovascular or pulmonary disease causation.

Are you aware of the statement and the study by NIOSH cited in last year's hearing there were significant differences between the pulmonary function of adult flight attendants and the normal adult population? Please comment.

What is the FAA's position on the petitions before the CAB to limit strictly smoking on short haul flights and small aircraft?

Answer. The FAA is aware of the study by NIOSH cited in the 1982 hearing regarding the differences between pulmonary function of adult flight attendants and the "normal" adult population. The study was based on a population of 140 flight attendants, all employed by the same airline, and based in New York, Miami, and San Francisco. This study did not include the smoking history of either the flight attendant or "normal" adult populations and the pulmonary function studies were non-standard. While this study did show differences in pulmonary function of flight attendants and the "normal" adult population, there was also a significant difference between the flight attendants based on the east coast and those on the west coast. coast.

In view of the small flight attendant population studied, non-standard testing, and the lack of smoking history, the FAA agrees with the NIOSH determination that the results of the study are inconclusive.

The Department of Transportation's comments on the CAB's proposals to limit smoking on short haul flights and small aircraft are enclosed.

Question. The FAA has had hands-on experience with jet aircraft for more than 20 years. Included in the regulations for pilot safety, and indirectly everyone's safety, are requirements for smoke evacuation from the cockpit to enable pilots to see outside the aircraft and view the instruments inside. Obviously, the purpose is to enable them to land an aircraft during emergency smoke conditions. Yet, in spite of the regulations and the equipment, pilots in the Air Canada disaster could not apparently see clearly.

What is the FAA doing to review this regulation to determine the adequacy of the smoke evacuation standards?

Answer. A problem in testing a cockpit ventilation system for a smoke overload, as might result from fire, is that the simulated smoke currently used in tests is unrealistically cool, with little thermal bouyancy effect. The FAA is working to develop a standardized smoke simulator which will more closely simulate the effects of fire on smoke and can be used in the testing of cockpit smoke evacuation.

Advisory material is now being developed for conducting smoke evacuation tests. It will contain guidance for the levels of light transmissity and the reduction of smoke density to a level which provides the pilot adequate view of essential flight instruments.

The primary means for protecting the cockpit crew in a smoke environment is the use of personal equipment for protective breathing and eye protection. The FAA recently issued TSO-C99 for this equipment and rulemaking action is underway to require that cockpit equipment specifically meet this TSO.

Question. How does the Inlet A Modification on the 727 affect air flow?

Why is the bleed altered on aircraft with this modification?

Answer. The Inlet A modification consists of a rearrangement of the vortex generators installed in the inlet duct of the center engine on the 727-200 to improve the airflow entering the engine. The bleed airflow is not altered by this modification.

There is, however, a backup bleed system on all 727 aircraft which enables the pilot to use sixth stage bleed air from the center (No. 2) engine for air conditioning and pressurization. The prime source of bleed air is from No. 1 and 3 engines. The backup system may be used to bring in added air to compensate for air lost in situations such as when No. 1 or 3 engine is shutdown. It does not increase cabin airflow under normal conditions.

Question. When air flow is reduced on the DC-10, carbon monoxide is shown to increase. Since the hemoglobin has a greater affinity for carbon monoxide than oxygen, wouldn't this increase in carbon monoxide interfere with the passengers' and flight attendants' ability to assimilate oxygen?

Answer. We have not had the opportunity to review the data that allegedly show that when air flow is reduced on the DC-10, carbon monoxide (CO) increases. In the FAA/NIOSH study of 1971, we found CO levels ranging from 2 to 5 pm (.0002 to .0005 percent) on MAC flights carrying a high proportion of smokers (57 percent). A level of .0005 percent CO in the air would not be expected to interfere with the passengers' and flight attendants' ability to assimilate oxygen.

Question. Doesn't the industry in fact have a self-interested motivation in denying the existence of an environmental problem?

Should the prospect of potential liability for maintaining poor—possible dangerous—working and traveling conditions be a sufficient deterrent to an independent investigation?

Answer. One can argue that regulated persons have an interest in concealing problems which might result in the promulgation of regulations they will be required to follow. We have generally found in the aviation industry, however, that there is a strong commitment on the part of most to detect problems, rather than hide them, and to take necessary actions to correct them. On the other side of the coin is the possibility that persons who market equipment, which is intended to "solve" a problem, may have a motivation to claim that a problem exists when it doesn't.

Question. It is our understanding that the 767 and 747 have the capacity to recirculate the cabin air. Since carbon dioxide cannot be removed from recirculated air, would recirculation affect the passengers' partial oxygen pressure at high altitudes?

Answer. The partial pressure of oxygen is not significantly affected because carbon dioxide cannot be removed from recirculated air. A fresh air supply, chosen by ASHRAE to be 5 CFM per person, is necessary to dilute the carbon dioxide produced by metabolism and then expired from the lungs. This allows an adequate factor of safety to account for health variations and increased activity levels. The fresh air supply per passenger of a fully loaded Boeing 767 is 10 CFM and 13.1 CFM for the 747. Since the air supplied to the passengers is much more than that specified by ASHRAE to compensate for carbon dioxide which is produced by the passengers, it may be concluded that the carbon dioxide has a negligible effect on the partial oxygen pressure at normal cabin altitudes. The Federal Aviation Regulations limit the maximum cabin altitude to be no more than 8,000 feet.

Question. In the ATA's prepared testimony, the following statement appears: "The airlines are vitally concerned about the health and welfare of their passengers and crews and encourage the reporting of medical complaints to airline representatives."

What are the airlines doing about the many reports of symptoms of hypoxia?

Do the airlines collect such information in systematic fashion and conduct evaluations and periodic analyses to determine the validity, frequency, and accuracy of the reports and passenger complaints?

Answer. It is our understanding that the airlines receive a fairly limited number of reports concerning hypoxia. We expect that individual airline procedures differ as to how complaints are followed-up, but, to our knowledge, airlines typically have medical complaints/reports reviewed by medical personnel.

Senator TRIBLE. Our next witness is Mr. John Ralph. Mr. Ralph, if you will step forward briskly with your associates, introduce them for the record and proceed. Your testimony will be made a part of the record in full; you are invited to summarize your testimony this morning.

STATEMENT OF JOHN RALPH, SENIOR VICE PRESIDENT, OPERATION AND TECHNICAL SUPPORT, AIR TRANSPORT ASSOCIATION OF AMERICA, ACCOMPANIED BY J. D. COLLIER, DIRECTOR OF ENVIRONMENTAL AFFAIRS; AND E. L. THOMAS, VICE PRESIDENT FOR ENGINEERING AND MAINTENANCE

Mr. RALPH. Thank you, Mr. Chairman. On my left I have Mr. Collier. He is the director of environmental affairs of the association; on my right I have Mr. Ed. Thomas, who is our vice president for engineering and maintenance.

In view of the fact that you have accepted our written testimony into the record, I will summarize very briefly our views on the issues at hand.

The proposed legislation reflects concern about three aspects of air travel: one, the quality of cabin air available to passengers and crew during normal flight; two, crew and passenger safety during such emergency conditions as in-flight fires and sudden depressurizations; and, three, the need for a medical data base to evaluate the potential for the spread of contagious diseases during air travel. I will address each of these in turn.

With respect to cabin air quality, let me summarize our views on the relevent issues in this area. First, with respect to cabin ozone, Federal Air Regulation 121.578 brought under control air quality problems associated with the ozone phenomenon.

Second, low humidity on flights, though bothersome to some, is not a health hazard. It is a comfort problem and it can be dealt with by fluid intake.

Third, with regard to tobacco smoke, the current practice is to provide separate seating accommodations for smoking and nonsmoking passengers, which balances the needs and wants of our passengers, and this seems to work quite well. The Civil Aeronautics Board has yet another rulemaking proceeding underwau on smoking.

On these related issues—ozone, humidity, and smoking—we believe regulatory activity is adequate and available literature in the field is sufficient. Therefore, we see no need for additional study or further data gathering.

With respect to the matter of cabin fire safety, the progress of technology is now at the stage where additional meaningful improvements can be made. The FAA has several regulatory actions under way to improve passenger safety in the event of in-flight fires. Notice of proposed rulemaking 83-14 seeks to improve the fire-resistant characteristics of seat cushions, and notice 83-15 addresses the objective of improving the marking of emergency escape paths.

The FAA also has priority rulemaking on lavatory and galley smoke detectors and automatic fire extinguishers in lavatory trash containers. The FAA has developed an improved standard for personal protective breathing devices for crew members and has issued a technical standard order on such an item. The FAA has announced a rulemaking project concerning the installation of these new improved protective breathing devices on aircraft for crew members.

Just recently the FAA Civil Aeromedical Institute completed a project that examined protective breathing devices for passenger use. CAMI tested the concept of modifying present-day oxygen masks for the passengers to improve protection from smoke and other contaminants. Another approach tested the concept of adapting smoke hoods to provide emergency oxygen in the event of cabin depressurization. The concept of modifying oxygen masks was found to be feasible, while the concept of modifying smoke hoods proved to be infeasible.

This quick summary of testing and regulatory activity indicates, we believe, that FAA is actively addressing the major areas of concern and as a result we believe it is unnecessary to legislate additional study projects in this area.

Speculation has arisen about the possibilities of communicating diseases from one passenger to another while traveling aboard aircraft. No scientifically valid data base which addresses this issue has ever been developed. The airlines are not qualified to conduct or administer medical research.

I would like to emphasize that nothing exists in our records or in our operating experience to lead us to believe that there is a problem here. But if it is the judgment of the Congress that this area needs to be examined more thoroughly, then it should seek out the most respected institutions of the medical community and get their views as to the need for a research project which we believe, in such case, should be directed at all transportation modes.

In summary, let me restate the principal views of the airline industry regarding the three generalized subject areas of S. 197. First, with respect to cabin air quality there is sufficient data available to assess problems and the current regulatory procedures are adequate.

Second, with respect to cabin fire safety there is extensive rulemaking underway and additional research and development is underway which will result in further rulemaking. Again, we believe additional studies are unnecessary and carry the potential for deferring ongoing activity.

Third, with respect to a study effort to create a medical data base we defer to the judgments of the medical community.

In closing let me state that the safety of our passengers and crew is our highest priority. We are prepared to support and assist in those activities which contribute to this goal. Thank you.

Senator **Trible**. Thank you, Mr. Ralph, for your testimony. I would ask the minority staff to fetch Senator Inouye and I will propose just one question, Mr. Ralph.

To what extent do the airlines shut down the operating packs after they have taken off these days?

Mr. **Ralph**. We do not have a standard. I believe it will vary by airline and aircraft. Most of the time I think you will find in flight that all of the packs are operating.

Mr. **Collier**. Might I add something?

Senator **Trible**. Please.

Mr. **Collier**. Don Collier.

After the previous hearings of 1982 before the subcommittee we received questions from the committee, one of which addressed airline habits of cutting air conditioning packs. We queried our members on this and the specific results were returned to us, which we reported to the committee in our filing dated June 28.

Generally, to summarize what we got back, some airlines do cut air conditioning packs back for fuel conservation. It does not seem to be widespread. They are aware that in doing so ventilation is decreased and they generally incorporate measures where the flight attendant population will report back to the flight crew if any circulation problems are being reported from the flight attendants or passengers.

In such case, the crew will reactivate the systems that have been shut down.

Senator **Trible**. Does the current practice reflect the conditions that you just described? The study was conducted last year.

Mr. **Collier**. Last year, that is right. We have not updated our study since that time.

Senator **Trible**. Senator Inouye is detained by his responsibilities elsewhere. He will be returning to the hearing but will not have an opportunity to ask you further questions.

I have no further questions. We are pleased that you are here.

Mr. **Ralph**. Thank you.

[The statement follows:]

STATEMENT OF JOHN E. RALPH, SENIOR VICE PRESIDENT—OPERATIONS AND TECHNICAL SUPPORT, AIR TRANSPORT ASSOCIATION OF AMERICA

Madam Chairman and members of the committee: My name is John E. Ralph. I am Senior Vice President, Operations and Technical Support of the Air Transport Association of America (ATA), which represents U.S. scheduled air carriers. I am accompanied by E. L. Thomas, ATA Vice President for Engineering and Maintenance, and J. D. Collier, Director of Environmental Affairs. We appreciate the opportunity to provide comments on S. 197 and related issues.

This proposed legislation reflects concern about three general aspects of commercial air travel: (1) the quality of aircraft cabin air available to passengers and crew during normal flight conditions; (2) crew and passenger safety and health during such emergency conditions as in-flight fires and sudden depressurizations; and, (3) the need for a medical data base that could be used to evaluate the potential for the spread of contagious diseases within the confines of an aircraft cabin. I would like to address each of these general aspects in turn in the hope that it will be helpful to the committee.

CABIN AIR QUALITY

This subcommittee conducted hearings on S. 1770, the predecessor to S. 197, in May 1982. ATA testified on May 20, 1982, drawing upon the aviation medical expertise available to the airline industry. Supplementary information was supplied June 28, 1982 in response to additional questions posed to ATA by the subcommittee. I shall summarize very breifly our views on the issues in this area. First, with respect to the issue of cabin ozone, FAR 121.578 brought under control air quality problems associated with the ozone phenomenon. Second, low humidity on flights, though brothesome to some, is countered by fluid intake. It is essentially a comfort problem and impractical to deal with. Third, with regard to tobacco smoke, the current practice is to provide separate seating accommodations for smoking and non-smoking passengers. This reasonably balances passengers' interests, and is acknowledged to work quite well. As you know, the Civil Aeronautics Board regulates smoking accommodations aboard aircraft, and a rulemaking proceeding—the tenth in as many years—is currently underway, with comments from the public scheduled to be received by November 28.

On these related issues, cabin ozone, humidity and tobacco smoke, we believe regulatory activity is adequate and the available literature in the field is suffcient. Therefore, we see no need for additional study or furher data collection.

CABIN FIRE SAFETY

With respect to the matter of cabin fire safety, the airlines have been working cooperatively with the FAA and NASA for a number of years to identify new opportunities for better fire and smoke protection and to suggest necessary tesing and demonstration activity to validate safety enhancements. We have supported the funding of the necessary research and devlopment efforts.

The progress of technology is now at the stage where it appears that meaningful improvements can be made in the area of cabin fire safety. The FAA has several regulatory actions underway that are aimed at improving passenger protection in the event of in-flight fire. Notice of Proposed Rulemaking (NPRM) number 83-14 seeks to improve the fire resistant characteristics of seat cushions, and Notice 83-15 addresses the objective of improving the marking of emergency escape paths. The airlines and manufacturers are evaluating these Notices on which comments are due February 8, 1984. The FAA also has a priority rulemaking project on requirements for lavatory and galley smoke detectors and automatic fire extinguishers in lavatory trash containers. The airlines will be participating actively in these regulatory processes.

Additional regulatory developments are in prospect. As the result of a cooperative effort among airlines, manufacturers, FAA and other organizations, an improved standard for personal protective breathing devices for air transport crew members was developed and published by the Society of Automotive Engineers (SAE) as SAE Aerospace Standard 8031. FAA has also issued Technical Standard Order (TSO) number C99 on protective breathing equipment for crew members, which incorporates by reference this SAE standard. The FAA has just announced that it has a regulatory project underway which will lead to rulemaking concerning the installation of TSO–C99 protective breathing equipment on airline aircraft for crew members.

Just recently, the FAA Civil Aeromedical Institute (CAMI) completed a project that examined protective breathing devices for passenger use. CAMI tested the concept of modifying present day diluter-type oxygen masks to provide improved protection from smoke and other contaminants. Another approach tested the concept of adapting smoke hoods to provide emergency oxygen in the event of cabin depressurization. The concept of modifying present oxygen masks was found to be feasible, while the concept of modifying smoke hoods proved to be infeasible. The oxygen mask modification consists essentially of a rebreather bag, which improves protection against smoke and contaminants released from inflight fires. It is our understanding that the FAA intends to conduct additional testing to refine the modification and to undertake cost/benefit analysis of practical designs.

This quick summary of testing and regulatory activity indicates, we believe, that the FAA is actively addressing the major areas of concern with respect to cabin fire safety. We believe that corrective actions in this area should be based upon careful evaluation of actual experience and the results of scientific analysis. Development of effective and reasonable rules that enhance safety can best be accomplished by adhering to normal rulemaking procedures which depend upon thorough analysis of empirical evidence, laboratory tests and demonstration, and careful attention to public participation and accountability. Comprehensive testing and regulatory actions are underway, and as a result we believe that it is unnecessary to legislate additional study projects in this area.

CREATION OF A MEDICAL DATA BASE

Speculation has arisen about the possibilities for communicable diseases spreading from one passenger to another while in the confines of an aircraft cabin. No scientifically valid data base which addresses the issue of the potential for the spread of disease in a systematic fashion as the result of air travel has ever been developed.

The airlines are vitally concerned about the health and welfare of their passengers and crews, and encourages the reporting of medical complaints to airline representatives. But the occasional complaint without augmenting information from the patient's personal doctor is not sufficient for the building of a rigorous, scientifically valid data base.

The airlines are not qualified to conduct or administer medical research. Nothing exists in our records or in our operating experience to lead us to believe there is a problem here. But, if it is the judgment of the Congress that this area needs to be examined more thoroughly, then it should seek out the most respected institutions of the medical community for assistance in developing a research project directed at all transportation modes.

SUMMARY

In conclusion, let me restate the principal views of the airline industry regarding the three generalized subject areas of S. 197.

First, with respect to cabin air quality, there is sufficient data available to fully assess problems and we believe the current regulatory procedures are adequate. The one subject of continuing policy debate in this area has to do with smoking, a matter currently the subject of a rulemaking proceeding. In this area there is a surfeit of data and we see no need for additional studies.

Second, with respect to cabin fire safety, there is extensive rulemaking underway, which addresses the major concerns expressed by the S. 197. Additional research, test and development, which will eventuate into further rulemaking, is also underway. Again, we believe additional studies are unnecessary and carry the potential for deferring ongoing activity.

Third, with respect to the desirability for an effort to create a medical data base which would be useful in assessing whether or not diseases travel by aircraft, we must defer to the judgments of the medical community.

Finally, and most importantly, let me restate that the safety of our passengers and crews is our highest priority. We are prepared to support and assist in those activities which contribute to the highest level of safety in air travel.

Senator Trible: Next we will call our first panel, Lisa Yates, director of health and safety, Independent Union of Flight Attendants; Janis Bumgarner, director of air safety, Association of Flight Attendants; Donald Denmark of Washington, D.C.

Welcome. Ms. Yates, you are at the center of the table, so I will look to you to introduce this panel's testimony. Perhaps you can begin and then yield to your colleagues at the table.

STATEMENTS OF LISA YATES, DIRECTOR OF HEALTH AND SAFETY, INDEPENDENT UNION OF FLIGHT ATTENDANTS; JANIS BUMGARNER, DIRECTOR OF AIR SAFETY, ACCOMPANIED BY SUSAN MILLER, HEALTH COORDINATOR, ASSOCIATION OF FLIGHT ATTENDANTS; AND DONALD DENMARK, FLIGHT ATTENDANT, UNITED AIRLINES

Ms. Yates. Thank you. My name is Lisa Yates. I am director of health and safety of the Independent Union of Flight Attendants.

We are gratified to be able to have the opportunity to present a statement today in support of S. 197.

Most of what I am going to say is on the record, I will try to be brief. Since the deregulation and, coincidentially, the price of aviation fuel took off, air carriers have been hard pressed to find methods of effecting cost-saving procedures, whether in marketing, sales, or in flight operations, reducing the weight of aircraft by removal of nonessential items, reducing quantity of fuel carried and reducing usage of inflight air-conditioning packs, all designed to reduce the amount of fuel consumed.

Air carriers are under pressure to turn a profit. This pressure on each carrier has simultaneously placed pressure upon the FAA to promote aviation, that is, to help each individual carrier to financially survive.

The Federal Aviation Act of 1958, in providing for the establishment of the FAA, unfortunately appeared to empower that agency with a double responsibility—that of enhancing aviation safety and also that of promoting the aviation industry. Our union feels very strongly that the two responsibilities cannot coexist without a severe compromise of one consideration over the other based on existing realities.

The question of ozone is an excellent example of FAA's seeming reluctance to initiate action. With the introduction of longer range, higher altitude aircraft, the Boeing 747-SP, came an unexpected and unwelcome visitor into aircraft cabins. It appears that at various times during the year ozone tends to descend in altitude and form clusters or fingers in the northern latitudes near the polar region.

The 747-SP which was introduced in 1976 began to routinely fly what were termed polar flights. Many of these flights were over 40,000 feet, higher than the average flight up until that time on other aircraft. Flight attendants were the first to notice adverse symptoms, which included such things as chest pains, coughing up small amounts of blood, severe eye irritation, nausea, dizziness, and burning sensation in the nose and throat.

Many flight attendants were quite frightened by these new and unexplained symptoms they began to experience en masse. Pilots initially did not experience these and that is attributed to the fact that sedentary individuals would not be affected as severely.

Carmen Azzopardi, my predecessor at IUFA, appeared before or contributed testimony to three congressional subcommittees investigating the aircraft cabin environment: In 1979, a subcommittee regarding adverse health effects of inflight exposure to atmospheric ozone; again in 1979 FAA and aviation safety issues; and in 1980 an FAA-OSHA jurisdiction over workplace safety.

We feel as a result of the first two hearings the FAA promulgated a standard for ozone in aircraft cabins. The airlines were free to choose, however, the method for meeting these standards. One was predicting the location of ozone concentrations and flying around them, restricting aircraft altitude, and also possibly installing ozone filtration devices.

We found very quickly the first two choices did not work, and ozone filtration devices were the choice. Charcoal filtering devices were the first attempt, and we found in some cases failure was noticed after 8 airframe hours. Catalytic ozone converters using reactive metals to break down entering ozone became the filter of choice. These proved to be lightweight and light on maintenance and we estimated 10,000 airframe hours.

However, recently we have had a surge of new reports on ozone again on our aircraft, and we respectfully submit that there is no way to be sure that 10,000 airframe hours is a standard we can trust. We feel such conditions as atmospheric smog, perhaps the extra volcanic ash that is up in the higher atmosphere, all of those things might be considerations that lower that 10,000-hour standard.

We also feel that there are no ozone monitoring devices on the aircraft and there is no way to monitor unless we can see on a routine basis what is happening at altitude.

All of the foregoing comments would appear to indicate that ozone is our only nemisis, but this is not true. Since about 2 years ago when air carriers began shutting down air-conditioning systems an entirely new set of breathing difficulties and related physical symptomology have manifested themselves.

Concurrence between my flight union and other flight unions draws a clear picture of a serious and continuing problem, which is lack of sufficient ventilation aboard many of our aircraft. My files are replete with complaints that have been submitted.

Air carriers, in my understanding, across the board are advising flight attendants to request cockpit cooperation in turning on the idle air-conditioning pack. Simultaneously, in a move that must cause a little bit of amusement in higher echelons, pilots are told to cut back fuel consumption to the bare minimums.

The flight attendants and pilots are basically being told two different things from management within the same companies. Specifically, flights are dispatched based on usage of only two air packs for the flight's duration. This technicality becomes a critical factor on long-range flights where no extra fuel has been budgeted to operate compressor pumps.

Flight attendants have become used to hearing that the reason our pilots are unable to comply with any request to turn on that third air-conditioning pack is this action might necessitate a fuel stop. In certain instances we have actually had that fuel stop and our flight attendants were berated for causing it.

Our union respectfully submits that everyone onboard the aircraft has a right to breathable air with adequate oxygen reasonably free of microbial and chemical byproduct contamination. This should not be a subject dependent upon the whims of a particular cabin or cockpit crew.

Breathable air should not be the subject of such controversy. This happens every day as we are literally pitting flight attendant against pilot to get that fresh air on the aircraft.

Out of deference to our FAA panel who spoke earlier, I do submit that restaurants and theaters have certain air standards, but I would also like to submit if I do not feel well in a restaurant or in a theater I can always walk out and get fresh air; I cannot do that on an airplane.

It is also no secret that airlines have lowered their fuel onboard minimums to actually below aircraft manufacturer recommended minimums, with FAA sanction. And it is fully understandable that pilots' concerns for such considerations as unexpected adverse weather, possible airport go-around if landing may be delayed, the possible need to stop for refueling, all weight understandably against the cabin request for additional ventilation.

So we flight attendants and passengers in the main cabin of the aircraft are caught unwittingly and helplessly in a situation which sees no solution short of an outside agency's assistance. It appears that the FAA's interests are too closely alined with air carrier profitability to provide any relief. We feel strongly that flight attendants and passengers have nowhere to go from here.

I have also been asked to present a very brief statement on behalf of the Association of Professional Flight Attendants, and they have an exhibit which is also part of the record of an ongoing study that is very timely and I believe should be part of this testimony.[1]

So I am reading this now on behalf of APFA. The Association of Professional Flight Attendants has recently experienced a new and debilitating set of symptoms not clearly associated with either cabin ozone levels or operation of ventilation systems in a particular mode. These symptoms began to be felt over a year ago and as APFA continued its investigations began to see a general pattern emerging.

This is all detailed in exhibit 2. The statement, which I am now quoting:

> The APFA recognizes through recent research with the Occupational Health Clinic at the San Francisco General Hospital that there is a serious situation existing on board our aircraft. More than 10 percent of our SFO—that is, San Francisco—international flight attendants have sought medical attention at this facility for upper respiratory irritation, while many more have been and are being treated by their personal physician for similar symptoms.

Several of our passengers are complaining to the flight attendants in addition to writing to our companies. They are also suffering from similar symptoms.

There are many contaminants within the cabin which may be unique to this environment and our concern is with the chemicals allegedly causing these irritations. Our company's corporate medical director has agreed that a comparison survey must be conducted and we are pleased that he shares our concerns and has offered to assist the APFA in our research.

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[1] The material referred to has been retained in the committee files.

We would like to submit the following two recommendations in conclusion. One, an industrial hygiene survey be conducted upon the completion of the comparison survey. Particular attention should be placed on those carriers which are determined to have the consistent problem with maintaining quality of air; and, two, all commercial aircraft should be equipped with an air quality measuring device.

In summary, for both of our unions we are requesting these monitoring devices on all aircraft. We also are requesting that one central agency without a special vested interest in the outcome of medical reports be established to receive, process and file all flight attendant health reports.

It is vital that this agency be independent, as the FAA has already admitted in prior testimony, part of last year's record, no flight attendant health records are kept by that agency. How can the FAA have jurisdiction over flight attendant health matters when they admittedly have no mandated system for even reporting illnesses and injuries to that agency?

So it is, therefore, not difficult in light of all the foregoing to comprehend their inability to determine the extent of problems in the work environment and to fashion any realistic solutions for these problems.

Thank you for the opportunity to testify.

[The statement follows:]

STATEMENT OF LISA YATES, DIRECTOR OF HEALTH AND SAFETY, INDEPENDENT UNION OF FLIGHT ATTENDANTS

My name is Lisa Yates. I am the Director of Health and Safety of the Independent Union of Flight Attendants. We are gratified to be able to have the opportunity to present a statement today in support of Senate Bill 197.

Since the Deregulation Act was passed, and coincidentally the price for aviation fuel "took off," air carriers have been hard pressed to find methods of effecting cost-saving procedures. Whether in marketing and sales (adding to existing seating capacity and lowering air fares) or in flight operations (flying at higher altitudes up to 45,000 feet, reducing the weight of aircraft by removal of non-essential items, reducing quantity of fuel carried, and reducing usage of in-flight air conditioning packs—all designed to reduce the amount of fuel consumed), air carriers are under pressure to turn a profit.

The bottom-line in all decisions appears to be, "Is it cost-effective? Can we save money? Can we get out of the red and into the black?" What has resulted in the wake of our Airline Deregulation Act is extreme pressure on air carrier corporations to succeed individually.

This pressure on each air carrier has, simultaneously, placed pressure upon the Federal Aviation Administration to "promote aviation," that is, to help each individual carrier to financially survive. The Federal Aviation Act of 1958, in providing for the establishment of the FAA, unfortunately appeared to empower that agency with a double responsibility, (1) that of enhancing aviation safety, and (2) that of promoting the aviation industry. Our union feels strongly that the two responsibilities cannot coexist within the same agency without a severe compromise of one consideration over the other, based on existing realities.

We maintain that two separate agencies must be individually responsible, else the FAA shall continue to be caught in what can only be defined as a Catch-22 situation. What is happening, in our aircraft cabins, is a direct result of this reluctance on the part of the FAA to act in favor of bona fide health concerns.

The question of ozone is an excellent example of FAA's seeming reluctance to initiate action. With the introduction of longer-range, higher altitude aircraft, the Boeing 747Sp, came an unexpected and unwelcome visitor into aircraft cabins. It appears that at various times during the year, ozone tends to descend in altitude and form clusters, or fingers, in the northern latitudes—particularly near the polar region. The 747Sp, introduced in 1976, began to routinely fly what were termed "polar flights," into these concentrated ozone clusters. Many of these flights routinely flew above 40,000 feet, higher than the usual altitude of 25,000 to 35,000 feet for other aircraft types. Again, flying higher was found to be a cost-saving procedure, allowing for lower fuel consumption.

The manufacturers of the SST foresaw the need for ozone destruction before outside air became cabin air, and allowed for this by using high engine heat in treating that air. To our knowledge, SST travelers have not experienced any pronounced adverse effects.

Flight attendants were the first to notice adverse symptoms. Some of them were quite severe, such as chest pains, coughing up small amounts of blood, severe eye irritation, nausea, dizziness, and burning sensation in the nose and throat. Many flight attendants were quite frightened by these new and unexplained symptoms they began to experience in groups. Pilots, initially, did not experience these symptoms and that has been attributed to the fact that sedentary individuals would not be affected as severely as physically active ones, where an increased respiration rate comes into play.

It took concerted effort, and prolonged persistence, including the personal delivery of over 300 health complaints to FAA headquarters. These 300 complaints were only from one carrier—and only from one flight attendant base—which indicated the potential for this problem to be universal. Many of the complaints which were directed to our carrier, were not acted upon seriously, and the expression, "hysterical females" was heard at least once. It is true, most of our ranks are comprised of females.

We believe that this "march" on FAA headquarters did help in prompting the FAA to issue an Advisory Circular, titled "Ozone Irritation During High Altitude Flight," which defined ozone irritation and described a means of dealing with the problem should it occur. This included partaking of Oxygen and placing a wet towel or cloth over one's nose and mouth; also, to cease physical activity for a brief time.

We are not, however, satisfied that the FAA has done all that the agency could to help the situation permanently.

Carmen Azzopardi, my predecessor at IUFA, appeared before or contributed testimony to three congressional subcommittees investigating the aircraft cabin environment. These included: (1) Adverse Health Effects of Inflight Exposure to Atmospheric Ozone, Hearing before the Subcommittee on Oversight and Investigations of the Committee on Interstate and Foreign Commerce, House of Representatives, July 18, 1979; (2) FAA and Aviation Safety Issues, Hearing before a subcommittee of the Committee on Government Operations, House of Representatives, August 13-14 1979; and (3) FAA-OSHA Jurisdiction Over Workplace Safety in the Aviation Industry, Hearing before a subcommittee of the Committee on Government Operations, House of Representatives, August 16, 1980.

As a result of the first two hearings, the FAA promulgated a standard for ozone in aircraft cabins. The permitted ozone level standards of 0.1 ppmv time weighted average [TWA] and 0.25 ppmv threshold limit value [TLV] were set and were in keeping with the existing OSHA standards for ozone exposure. However, the airlines were free to choose their own methods to meet these designated standards. These methods included one of three choices:

(1) Predicting the location of ozone concentrations and flying around it;
(2) Restricting aircraft altitude in order to avoid the tropopause;
(3) Installing ozone filtration devices.

In regard to the first option, tracking of ozone movement cannot be performed with absolute certainty. In my personal experience, we had been routed along certain corridors in hopes of avoiding ozone, yet, in numerous instances (only hours after a "clear" routing had been given our flight) we found we experienced the classic symptoms, again, some very severely.

Restricting aircraft altitude, although a possible solution, was quickly shown to be economically nonfeasible. It cost more money to fly below the ozone.

Having established that flying around or below predicted concentrations of ozone would not work, the only choice remaining—installing ozone filtration devices—was the FAA's only alternative.

Charcoal filtering devices were the first attempt, and although these devices helped alleviate symptoms initially, the life of these devices was totally unreliable. In some cases, failure was noted after eight airframe hours.

Catalytic Ozone Converters, using reactive metals to breakdown entering ozone, became the filter of choice. These proved to be light-weight and light on maintenance. Boeing engineers estimated the average life of these converters to be 10,000 airframe hours.

Unfortunately, a very important consideration has been entirely bypassed, which would assure adherence to these new ozone standards: there are/were no provisions made for routine monitoring of ozone levels in-flight. Although the standards have been set, there is in place no way to ascertain that these "safe" levels are being maintained.

Our union, based on a surge of ozone-related flight attendant reports which were received earlier this year, respectfully submits that we do not feel the 10,000 hour-average is a certainty. We do not feel that individual flight attendant reports which are being channeled through our company are getting the attention they deserve. I have been told by company officials, placed rather high, that we, the flight attendants have no way of knowing whether we are experiencing excess dehydration in the cabin or are experiencing ozone symptoms. Therefore, due to the well-repeated phrase "those hysterical females," our reports once again, seem to be essentially ignored.

We submit that it is impossible to assure maintenance of health standards, in this case ozone concentrations, without a monitoring device in the cabin. We feel that it would be a terrible injustice if 300 of our flight attendants had to march, once again, to get our message home, that WE ARE suffering from respiratory symptoms, a good percentage of which appear to our union to be, once again, related to higher than normal ozone levels.

Even with all of the public concern over ozone levels, the FAA provided a Notice of Proposed Rule Making in the Federal Register on November 23, 1981. This Notice responded to a Petition of Rule Making from the Air Transport Association of America (ATA) which proposed an exclusion of cargo aircraft and certain narrow-body jet aircraft. This Notice proposed to relieve Operators of those aircraft from the responsibility of maintaining ozone control equipment. Further, the Federal Register is replete with Petitions for Exemption from individual air carriers, to continue to extend the compliance time for installation of these devices. All petitions were granted as they were filed.

All of the foregoing comments would appear to indicate that ozone is our only nemesis in the aircraft cabin. Since about two years ago, when air carriers across the board began shutting down air conditioning systems as a new cost-saving procedure, an entirely new set of breathing difficulties and related physical symptomology have manifested themselves. Concurrence between my flight attendant union and other unions draws a clear picture of a serious and continuing problem: lack of sufficient ventilation aboard many of our aircraft.

My files are replete with flight attendant complaints that have been submitted to our company. Result? Nothing has been done to alleviate our breathing difficulties. Air carriers, again, across the board, are advising flight attendants to request cockpit cooperation in turning on the idle air conditioning pack during meal services when smoke and increased flight attendant activity appear to produce particular distress. Simultaneously, in a move that must cause some certain amount of amusement in the higher echelons within our company, pilots are told to cut back fuel consumption to the bare minimums. The flight attendants and pilots are basically being told two different things from management within the same company. Specifically: Flights are dispatched based on usage of only two air packs for the flight's duration. This technicality becomes a critical factor on long-range flights, where no extra fuel has been "budgeted" to operate compressor pumps. Flight attendants have become used to hearing that the reason our pilots are unable to comply with any request to turn on the third air conditioning pack is this action would necessitate a fuel stop! In certain instances where that fuel stop was initiated, flight attendants were berated: they were told they "caused" the fuel stop due to demand for air.

Our union respectfully submits that everyone on board the aircraft has a right to breatheable air, with adequate oxygen, reasonably free of microbial and chemical by-product contamination. Breathable air should not be a subject dependent upon the whims of a particular cabin and/or cockpit crew. Breathable air should not be the subject of such controversy as is the case daily, when company mandates have pitted, literally, flight attendant against pilot in the quest for a decent cabin environment.

It is no secret that airlines have lowered their fuel-on-board minimums, to below aircraft manufacturer minimums with FAA's sanction. Pilots concerns for such considerations as unexpected adverse weather, possible airport go-around if landing may be delayed, the possible need to stop for refueling enroute, all weigh understandably against the cabin request for additional ventilation. So, we, the flight attendants and passengers in the main cabin of the aircraft are caught, unwittingly and helplessly, in this situation which sees no solution short of an OUTSIDE agency's assistence. It appears that the FAA's interests are too closely aligned with air carrier profitability to provide any relief. The flight attendants and passengers have no where to go from here.

The Civil Aeronautics Board, since deregulation and CAB's expected sunset shortly, appears to be unwilling to take any direct action regarding cabin ventilation and smoking aboard aircraft. A Notice of Proposed Rule Making is being suspended indefinitely, that would have established some minimums. This Notice, 14 CFR Part 252, SMOKING ABOARD AIRCRAFT, has even backed down from an earlier rule which required all ventilation systems to be functioning when smoking was taking place aboard the aircraft: to read—"banning smoking when the aircraft ventilation is *not* adequate" was proposed to replace the wording "banning smoking when the aircraft ventilation is not fully functioning."

Since it appears that we are unable to enforce the ozone standards (no monitoring devices on board), how are we to enforce this new "adequate" provision. As I submitted in my response to the CAB on this NPRM, does "adequate" mean: (1) adequate to sustain life—that is all cabin occupants have physically survived the flight? or (2) adequate to sustain comfort—that is, all cabin occupants state they feel no unpleasant physical sensations, or (3) adequate to sustain health—that is, they can state they appear to be free of symptoms associated with upper respiratory infections, etc. Adequate is so general that any attempt at enforcement of even a minimal comfort standard would become difficult. (Exhibit 1).

Air carriers have an automatic alternative to the above requirement, a Minimum Equipment List item, FAA-approved which allows for the release of any aircraft with one non-functioning air conditioning pack, provided repair can be made at a subsequent station where parts would be available. Therefore, the "fully functioning" provision should not hamper aircraft movement noticeably.

The Association of Professional Flight Attendants has recently experienced a new and debiliting set of symptoms, not clearly associated with either cabin ozone levels or operations of ventilation systems in a partial mode. These symptoms began to be felt over a year ago, and as APFA continued its investigations, began to see a general pattern emerging. I have been asked to include their brief statement, and accompanying Exhibit 2 with our presentation: Exhibit 2 comprises the Interim Report #1 compiled as a preliminary report by the Occupational Health Clinic of San Francisco General Hospital. APFA's Statement:

"The APFA recognizes through our recent research with the Occupational Health Clinic at the San Francisco General Hospital that there is a serious situation existing on board our aircraft today for the passengers in addition to the crew.

More than 10 percent of our SFO International flight attendants have sought medical attention at the Occupational Health Clinic for upper respiratory irritation recently; while many more have been and are being treated by their personal physician for similar symptoms.

Several of our passengers are complaining to the flight attendants in addition to writing to the Passenger Services Department. They are also suffering from similar symptoms.

There are many contaminants within the cabin which may be unique to this environment. Our concern is with the particulate matter in addition to the chemicals allegedly causing these irritations.

With the surveys completed to date we have determined that further research must be completed.

Our company's Corporate Medical Director has agreed that a comparision survey must be conducted in order to property evaluate the problem. We are pleased that he shares our concerns and has offered to assist the APFA in our research.

In conclusion we submit two recommendations:

(1) An Industrial Hygiene Survey be conducted upon the completion of the comparison survey. Particular attention should be placed on the carriers determined to have a consistent problem with maintaining quality of air which allows their passengers and crew to breathe healthful air, and (2) All commercial aircraft be equipped with an Air Quality Measuring Device. Thank you. This report has been respectfully submitted by: C. I. Stevens, APFA."

In conclusion, we are requesting monitoring devices on board all aircraft. We also are requesting that one central agency, federal-level and without a special vested interest in the outcome of medical reports, be established to receive, process, and file all flight attendant health reports. It is vital that this agency be independent of preordained ties with air carriers, aircraft manufacturing companies, and even independent of ties with Corporate Medical Directors. We do feel that a central agency is needed to keep our records in addition to our air carrier Medical Departments. As the FAA has already admitted in prior testimony, no flight attendant health records are kept by that agency. HOW CAN the FAA have jurisdiction over flight attendant health matters when the agency admittedly has no mandated system for reporting flight attendant illnesses and injuries?

It is not difficult, in light of all of the foregoing, to comprehend the FAA's inability to determine the extent of problems in the work environment and to fashion any realistic solutions for these problems.

Both IUFA and APFA fully support the provisions of Senate Bill 197, which if passed, would require an independent study of airline industry practices and FAA rules relating to air quality in aircraft cabins.

Thank you for giving us the opportunity to testify.

Senator TRIBLE. Ms. Yates, thank you very much for your very complete and thorough testimony. Who else would like to submit testimony at this time?

Ms. BUMGARNER. I will be next.

Good day. My name is Janis Bumgarner. I am director of air safety for the Association of Flight Attendants. Our association represents 21,000 flight attendants from 14 carriers. With me this morning is Susan Miller. She is our health coordinator. We are here today to support bill S. 197, which seeks to determine the adequacy of aircraft cabin air.

In 1982, AFA presented testimony to this subcommittee that clearly indicates that our members were having respiratory and other physical problems all relating to the ventilation system. We compiled 297 reports from flight attendants who experienced problems in breathing and blood circulation and discomfort in their eyes, nose, and throats.

Many of these symptoms parallel the effects produced by a deficiency in oxygen known as hypoxia. One of the first symptoms of hypoxia is fatigue and drowsiness and that is why, for safety's sake, the cockpit does receive 4 to 20 times as much fresh air per cubic foot as the occupants in the cabin.

The aircraft is our work environment and our duties call for much physical activity. We are in there pushing and pulling carts, lifting trays, walking back and forth, uphill and downhill, and dealing with stressful situations. Therefore, when there is a deficiency in the oxygen supply, the first symptoms will show up in people having the greatest need for oxygen, such as flight attendants, because of their active state, and passengers who are in poor health.

We are here again before the subcommittee to say that the problem has not solved itself and gone away. We have additional reports of breathing difficulties and symptoms of illness from our members. Since May of 1982, when we last testified here, we have gotten 254 additional cases from our members. This brings our total to 551 reports from crew members.

We remind you that these reports are voluntarily sent to us by the flight attendants, and it does represent just a portion of the problem in the field. We are not copied in on all reports the company receives, and many flight attendants do not write reports up. Nevertheless, the numbers are significant enough to say that it is a matter that deserves investigation.

One major carrier that we represent did respond to the number of complaints of respiratory difficulties by performing an in-house study. The study evaluated five irritants—carbon monoxide, cigarette smoke particulates, carbon dioxide, and ozone and humidity levels. The report concluded that the contaminant levels were below established standards for the workplace and it essentially gave the carrier a clean bill of health.

We were very uncomfortable with the findings and with the legitimacy of the study, so we sent the study to three independent experts to have them review and critique the study. All three experts came back and reported that the study was too limited and biased to be valid, and copies of their critiques are attached as exhibit 1.[1]

The FAA and the carriers say there is not a problem, but our members continue to experience physical ailments and some are no longer able to fly as a career because of respiratory illness. We cannot say where the problem is coming from.

Possible sources which we hope your study will look at are: one, the carriers 'practice of using less than all available air packs during flight in order to lower fuel consumption; two, a lowering of upkeep of the grilles, filters and ducts of the ventilation system; three, flying at higher altitudes which affects the plane's ability to keep the cabin altitude at a constant rate.

Many of our cross-country flights now are flying at cabin altitudes close to or at 8,000 feet and we have been told that at 8,000 feet the first symptoms of hypoxia appear.

The fourth thing we would like to have the study look at is the cumulative effects of exposure to such an environment. We are here to ask that money be appropriated to investigate this problem.

We thank Senator Inouye very much for addressing this problem and we hope that other members will join us in supporting bill S. 197. Thank you.

Senator Trible. We thank you for your testimony.

Mr. Denmark.

Mr. Denmark. Thank you, Senators. I appreciate this opportunity to testify on S. 197, and I am here to assure you that we flight attendants on United Airlines property are having problems with the aircraft environment.

Due to increased fuel costs, the airlines are making every effort to decrease the fuel used. Some measures include flying at higher altitudes, the recirculation of cabin air and the amount of air supplied to the cabin. Since the advent of these measures contamination levels seem unusually high.

Cigarette smoke is often unbearable and flight attendants, quite frankly, are suffering from symptoms of hypoxia or oxygen deprivation to the brain. These symtoms include tunnel vision, decreased mental proficiency, loss of mobility, drowsiness, nausea, and headache. I have observed these symptoms in myself and in my flying partners.

One frightening aspect of hypoxia is that once the symptoms occur flight attendants are unable to make the determination that additional oxygen is required and less likely to complete the task of obtaining needed oxygen once it is recognized.

The airlines choose to ignore the problems and offer no training to flight attendants to help them recognize modified behavior that is associated with hypoxia—in themselves, in their flying partners and in their passengers.

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[1] Exhibit 1 has been retained in the committee files.

Of particular concern to many flight attendants is that if we, as healthy adults, are being adversely affected, what is happening to those passengers with respiratory diseases, cardiovascular disease, the unborn, the pregnant or the elderly. Every indication shows that we need to study these problems.

As a result of my personal experience I filed a grievance in January of 1982 based on the worsening of my working conditions. In the decision, United Airlines stated:

> The evidence presented demonstrates that our passengers, as well as our flight attendants, have a varying sensitivity to pollutants which might be found in the aircraft cabin environment. It is well documented that certain individuals and persons with special health problems are sensitive and require a more controlled environment. This does not mean the company has a responsibility to provide such an environment.

This decision ends, "In conclusion, all United aircraft meet certification standards and comply with FAA regulations.

Gentlemen, this reasoning is circular, since the FAA maintains few standards on cabin environmental conditions. The level of conduct to which a carrier is expected to adhere to is very low. Moreover, those standards that do exist may be seriously outdated. As our knowledge of environmental and medical sciences grows, the FAA should not be reluctant to reexamine its policies, to reevaluate its standards and propose new ones if required. As long as passengers and employees of the airline industry are being adversely affected, the FAA needs to reevaluate its current reasonings and be willing to change them.

The ATA stated that if a study comes out of this hearing that all modes of transportation should be studied. Well, I am afraid they missed the general point. That is, the airline industry is the only industry that must offer life support systems. I strongly urge an independent study.

In response to Mr. Beard's statement that he would not wear an oxygen mask if you paid him, he obviously was not onboard my flight on October 18, 1981. Flight 144 from Seattle to Chicago was cleared for takeoff in heavy fog; no one was cleared to land. As the DC-10 jerked due to a malfunction of the right engine, the cabin filled with heavy smoke.

I could no longer see the passengers in the back cabin, but I could see them up front, and they were heading for the doors in flight. Senators, I would like to give you my definition of terror. It was watching those passengers reach for the door and hoping that door would not open.

We were lucky. The engine was shut down. The smoke cleared in 15 to 20 minutes, but we were unable to land for 1 hour and 6 minutes due to heavy fog in the area. We were forced to fly on to Spokane, Wash. Had the smoke continued, we would have needed smoke protection to sustain life or chance a landing at Seattle with no visual.

It is no secret that fire in a closed environment 7 miles above this Earth is extremely dangerous. Smoke can kill in a matter of minutes. It is only logical that early warning devices be installed in the lavatories to alert crew members of smoke. In an aircraft environment minutes in smoke mean lives.

Gentlemen, I am a resident of the District of Columbia and in this city I am required to have a smoke alarm in my home. I have two residents that live in my home and I have no farther than 50 feet to go to get away from smoke. And yet when I work 7 miles above this Earth in a cabin environment that contains 421 people, there is no early warning system. Gentlemen, 50 feet is a long way to go in heavy smoke; 7 miles is an eternity.

I thank you for this opportunity to testify.

[The statement follows:]

STATEMENT OF C. McDONALD DENMARK, FLIGHT ATTENDANT, UNITED AIRLINES

Madame Chairman and Members of the Subcommittee: I appreciate this opportunity to present my views on S. 197. As a Flight Attendant for United Airlines I have grave concerns over current industry practices with regard to pressurization and ventilation of aircraft cabin environments.

Due to the increase in fuel cost the airlines are making every effort to decrease the fuel used. Some measures include flying at higher altitudes, the recirculation of cabin air and the reduction of the amount of air supplied to the cabin.

Since the advent of these measures contamination levels seem much higher. Cigarette smoke is often unbearable and many flight attendents are complaining of symptoms related to hypoxia. Tunnel vision, decreased mental proficiency, loss of mobility, drowsiness, nausea and headache. I observed these symptoms in myself and my flying partners. Flight attendants with college degrees are unable to perform third grade math functions to complete liquor and movie forms. The loss of memory is accepted as normal by most flight attendants today.

One frightening aspect of hypoxia is once the symptoms occur that flight attendant is unable to make the determination that additional oxygen is required and less likely to complete the task if it is recognized.

The airlines choose to ignore the problem and offer no training to flight attendants to help them recognize modified behavior that is associated with hypoxia in themselves, in their flying partners and in the passengers.

Of particular concern to many flight attendants is that if healthy adults are having problems with the cabin environment what affect is that environment having on passengers suffering from respiratory problems or heart disease? The elderly, the unborn or the pregnant?

Every indication shows a need to study the health problems that are surfacing especially in this time of deregulation.

The result of my experience and observation was a grievance filed in January 1982 based on a worsening of working conditions. (See attached.) In that decision United Airlines states: "The evidence presented demonstrates that our passengers, as well as our flight attendants, have a varying sensitivity to pollutants which might be found in the aircraft cabin environment. It is well documented that certain individuals and persons with special health problems are sensitive and require a more controlled environment. This does not mean the Company has a responsibility to provide such an environment."

The decision ends with: "In conclusion, all United aircraft meet certification standards and comply with FAA regulation."

This reasoning is circular since the FAA maintains a few standards on cabin environmental conditions. The level of conduct to which a carrier is expected to adhere is very low. Moreover, those standards that do exist may be seriously outdated. As our knowledge of environmental and medical sciences grows, the FAA should not be reluctant to re-examine its policies, re-evaluate its standards, and propose new ones if required. As long as passengers and employees of the airline industry are being adversely affected, the FAA needs to re-evaluate its current reasoning and be willing to change them.

I strongly urge an independent study of the aircraft cabin environment.

Another item of concern involves smoke protection and early warning smoke devices.

On October 18, 1981, flight 144 from Seattle to Chicago was cleared for take-off in heavy fog. Approximately four minutes later, the right engine malfunctioned. As the DC-10 jerked, heavy smoke filled the aircraft cabin. I could no longer see the passengers in the back of the plane. However, I was able to watch the forward cabin passengers head for the doors inflight. We were lucky. The engine was shut down and the smoke cleared in 15 to 20 minutes, but we were unable to land for one hour and six minutes due to the area's heavy fog and were forced to fly to Spokane, Washington. Had the smoke continued, we would have needed smoke protection to sustain life for the flight to Spokane or risk a landing at Seattle where the runways were closed due to fog. Simply stated, wet paper towels are not enough.

It is no secret that a fire in a closed environment seven miles above the Earth is extremely hazardous. Smoke can kill in a matter of minutes. It is only logical that early warning devices be installed in the lavatories to alert crew members of excess smoke. Minutes mean lives.

Senator TRIBLE. Your testimony presents very powerful support for the inquiry sought by Senator Inouye. I am pleased that you are here and I am pleased that you have added your own experiences and insights for the record.

Let me ask just a couple of questions and then I will yield to the Senator from Hawaii.

The FAA seemed to suggest that ozone levels are monitored. Is this consistent with your own experience or not?

Ms. YATES. Onboard monitoring is not taking place at this time, no.

Senator TRIBLE. Should it and, if so, how would that be accomplished, if you are in a position to say?

Ms. YATES. The only thing I could figure would be with a mechanical detecting device that would actually tell you when you were above certain levels. If you go beyond, for example 0.25 parts per million per volume of air you are in a danger zone as far as intake of ozone and you should descend at that time.

I believe that should become an established procedure or move away from the ozone contamination. We have no way of knowing. We have certain symptoms that we feel, but when we have come to our own company with them they are telling us it is probably just extreme dehydration you are feeling.

Senator TRIBLE. Extreme what?

Ms. YATES. Extreme dehydration. We have been told by our own management that we cannot tell when we are feeling ozone or when we are feeling a dry cabin. So they do not take any stock in reports we send after a flight. Therefore, without the detector onboard no one believes us. That is the bottom line.

Senator TRIBLE. You have set forth in very compelling terms an array of symptoms. Obviously the symptoms suggest a problem, one that has not yet been well defined. Have any comparisons been made between the average number of days a year a cabin attendant is out of work because of illness as compared to the average for people who work in public areas generally on the ground?

Ms. YATES. I do not know of any studies personally between flight attendants and ground people.

Senator TRIBLE. Doctor, are there such studies, to your knowledge?

Ms. MILLER. I am sorry, it is Susan Miller, and I am not a physician, but that is very nice of you.

I do not know that any studies have been done that I am aware of between flight attendants and people in similar ground jobs. I know that there have not been any done comparing any of the different airlines because we tend to fly very different route structures.

Lisa is involved in some very long flights compared to someone like a commuter flight attendant. One of the things that has thrown off the statistics and which would influence studies if they were done is that we are consistently seeing flight attendants more and more disciplined for any time off they do take for sicklist usage. And so flight attendants instead of removing themselves from the schedule when they are incurring these symptoms are continuing to fly sick.

Another one of the reasons we would like to see the study done is when flight attendants do become sick en route because of chest pain, hyperventilation, breathing problems, sore chest, eyes burning, they cannot see, it is being denied as an occupational sicklist usage, and so it is not being reported to the States' workmans compensation departments.

So again the records are not being channeled there, and as long as it keeps getting thrown back into a dependability arena and a sicklist arena and a personal issue with the flight attendant involved, we are not going to see changes taken on a State level or a Federal level.

Senator TRIBLE. You have set forth reasons why it is believed the airlines have reduced the use of air packs for energy conservation and cost considerations. Who decides precisely how many air packs are operated?

Ms. YATES. It is in our aircraft operating manual. Every aircraft that operates has a manual that tells the pilots, tells the flight engineer when to shut off certain systems, when to turn certain systems on. They are trained in this, very highly trained. I have seen a copy of this manual and it does state—if you like, I can have it sent in—it does state very clearly that you simply take the aircraft on inner-three air pack mode position, but as soon as you reach proper temperature and air pressure you shut off one pack and that is standard procedure.

Senator TRIBLE. So that is corporate policy, then?

Ms. YATES. Yes, it is, sir.

Senator TRIBLE. Now is the supply of fresh air increased if passengers or cabin attendants complain?

Ms. YATES. I am sorry; I did not understand the question.

Senator TRIBLE. If passengers or cabin attendants complain and ask for more fresh air, what kind of response do you get?

Ms. YATES. Well, it seems very clear that we should get a positive response in all cases. However, my understanding is the pilots are under pressure. Again, at the end of the flight the company checks the fuel tanks to see how much fuel is left over, and it is my understanding that the pilots are under pressure to use the least amount of fuel possible between two points and that the company does keep a record of it.

All I can say is when that flight is dispatched they are on minimums and the pilots are under pressure to keep that fuel for weather, for go-arounds, for anything, and if we are in an 11- or 12- or 13-hour flight, which we are on nonstop, asking for that third pack on it may become a critical factor at the other end of the flight, so we do get resistance, unfortunately, which is understandable.

Senator TRIBLE. Yes.

Ms. Miller. Senator, if I may, also the carriers that AFA represents, we are seeing the same type of thing on some of our larger carriers. Pilots or captains of the aircraft have an individual tracking system where they in fact are even competing against each other to reduce fuel usage—a tremendous economic burden on the airlines.

And this is one of the ways they can reduce the costs. So captains are being held accountable individually for the amount of fuel they are using.

Another one of the problems that we have is because pilots are sedentary. Because of the increased flow to the cockpit they do not experience the same symptoms and there is a feeling out there that in fact it is psychological on our part, that that is an issue that flight attendants have gotten a little bit hyped about, and it is really kind of in our heads.

Mr. Denmark. Senator, I would like to address that.

The flight attendant group is the only job group that breathes with you. The pilots are on a separate air system. I tell you on the last four flights on a wide body, two out of the four times—that is 50 percent—the pack was broken. It was deferred and had been broken for days, so they could not have turned it on even if you were suffocating.

Senator Trible. Let me ask you a further question about the distinction drawn between the air for the pilots and for the rest of us. The FAA witnesses suggested that indeed it is the same air. Is the difference that it is recirculated at a higher frequency in the pilot's environment, or is it something beyond that?

Mr. Denmark. It comes from the same engine. There is one main pipe that comes in and then the pilots get a separate air flow off that pipe. It goes into the cockpit and is dispelled out of the cockpit. It does not normally come back into the cabin. The reason being is if there is smoke in the cabin the pilots do not want to be exposed to that smoke—smoke from fire or even delapidating effects that are caused from cigarette smoke.

So in effect they are on a separate air system, but it is the same engine that creates that air.

Senator Trible. Is it also a higher volume of air?

Mr. Denmark. I understand it is quite a bit higher, yes.

Ms. Bumgarner. We do have it. It is 4 to 20 times more per cubic foot of fresh air in the cockpit than in the cabin.

Senator Trible. And so it is a greater frequency of circulation and it is, by your best judgment, different air, generated perhaps by the same source but different air—not the same air?

Mr. Denmark. That is correct, the same source.

Senator Trible. Senator Inouye.

Senator Inouye. I found this to be not only fascinating but rather sad because, as some of you know, I travel, quite frequently, as much as flight attendants. I just got back from Seattle last night and I am leaving Thursday night for Honolulu. So I may have to change my mind.

You people fly often. Would you consider hypoxia as being commonplace, or is it some rare, rare occurrence?

Mr. Denmark. I talked to Dr. Kohn from United's medical department last week. He believes that hypoxia is rare. However, he personally has seen 20 to 30 flight attendants in Washington, D.C. alone, in the last 2 years. That is one airline, one domicile. I think that is high. Most of the time, due to disciplinary action that is taken by the company for excessive sicklist the flight attendants that are aware of hypoxia will not report it to the medical department and due to a lack of education many are not even aware that they are suffering from oxygen deprivation.

It has an insidious effect. It begins and everything seems quite normal and you get sort of giddy. The last time it happened to me it reached the point where suddenly I realized that something was wrong. I thought I was having a stroke but by the time I was aware of it I could no longer move my mouth to tell someone I needed help.

Senator **INOUYE**. Did you report that?

Mr. **DENMARK**. Yes. Not only was it reported, a grievance was filed with the company due to that incident.

Senator **INOUYE**. Now you said that disciplinary action would be taken if you report in sick. What do you mean by that?

Mr. **DENMARK**. Well, for example, I have had five instances of hypoxia onboard aircraft in the last 2½ years. They are all documented. Recently I received an oral warning, for excessive sicklist. Excessive sicklist when I was hired in 1973 was six times on sicklist. Today, in my case, United considers three times on sicklist excessive for 1 year.

Basically they are taking disciplinary action against me because I am having problems assimilating oxygen onboard their aircraft.

Senator **INOUYE**. You mean they are planning to fire you?

Mr. **DENMARK**. Exactly.

Ms. **YATES**. May I add to that? I represent a different union of flight attendants and we are experiencing the very same thing. We are having flight attendants terminated for excessive absences because they are ill. As a result, we are flying ill.

Senator **INOUYE**. Realizing that that may endanger the health of the passengers?

Ms. **YATES**. Absolutely, but we want to keep our jobs, because there is great pressure to not call in sick.

Senator **INOUYE**. I have been told that the 767 has ventilation problems. I was given this information by other flight attendants. What are the problems?

Ms. **MILLER**. Senator Inouye, I am not sure at this point whether in fact it is a ventilation problem on the 767 or more a problem of cabin altitude on the 767. We are seeing more reports of alleged hypoxia, but the 767 consistently flies at a higher altitude, consistently flies at 8,000 feet.

In the past, 6,000 feet was probably an average, and so studies have been done showing that the first signs of hypoxia in a resting healthy male are evident at 8,000 feet. Here we have a cabin environment where we have a predominantly female population. We have a very active, physically working population. There has not been much done to show how women are subject to hypoxia—if it is different, what the effects of hypoxia are on you when you consider all the other contaminants in the air in conjunction with the cigarette smoke.

That is one of my questions about the study that Mr. Beard talked about earlier that was done in 1971. At that time, again, planes were flying at a lower average altitude than we are seeing now. I think that may have some bearing on the changes and the increased reports we are seeing from flight attendants now.

In conclusion, I do not know that we know enough about the 767 at this time to know whether it is a problem of cabin altitude or whether it is a problem with the air quality itself.

Senator **Inouye**. Madam Chairman, I have one more question.

What are your thoughts on smoking? Maybe I am sensitive because I do not smoke.

Mr. **Denmark**. Senator, smoking should be banned from the aircraft totally. Cigarette smoke is nothing less than carbon monoxide, and carbon monoxide at 7 percent level in air is lethal. It also interferes with your body's ability to assimilate oxygen and at higher altitudes the partial oxygen pressure of the environment is already reduced.

Ms. **Bumgarner**. We do represent 14 carriers, and our official position is, one, under the present CAB proposal of banning smoking on flights of 1 hour or less, we are supporting that ban.

Our main problem with supporting an overall ban on all flights is the problem of enforcement. Flight attendants are victims of assaults and we have had in the last 2 years an increase in the number of assaults on flight attendants, and we are seeing that the carriers and the FAA, although there is a regulation on interfering with flight attendants in their duties, and they could follow through with fines and prosecution of passengers that do assault flight attendants, they are not doing that.

And we are being told that the reason they are not doing that is that they have decided to ask their legal department to focus more on the problems with the air traffic controllers. So problems with assaults on flight attendants are not being followed through by the FAA and we have had to take them into court on our own.

So we do feel that the incidence of assaults will increase if we are expected to enforce such legislation as a complete ban on smoking. But as a work environment, with the pack system and the ventilation system the way it is, it is a problem for all passengers and especially for our flight attendants.

We have a common phrase that we call the blue haze—working in the blue haze. If you are working in this environment and the smoke does rise higher than the level of seated passengers, it is actually rising to the point where the flight attendants are walking through it. We are experiencing a lot of problems with this. We are having a lot of flight attendants who have had to leave the line because of long-term respiratory problems.

And the reports I am getting are that their lungs look very much like smokers', although they do not smoke.

Senator **Inouye**. Does it make any difference whether you are sitting in the smoking or nonsmoking area?

Ms. **Bumgarner**. There is some difference.

Senator **Inouye**. Other than having the smoke puffed in your face, is there any other difference?

Ms. **Yates**. Let me answer that by saying if you are right in the middle of a smoking section you are right in the thick of it, so to speak. I have in numerous cases sat, for example, in first class or in nonsmoking and still I can detect a telltale odor of cigarette smoke traveling to a different part of the aircraft. It is greatly reduced, definitely, but there is definitely some intermixing of total air within that aircraft.

In answer to your question about banning smoking, I think it should be done, but only on short flights—perhaps less than 2 hours. The reason is we have several patterns where we might do 5 or 6 flights a day, 1 hour each, and we are hopping up and down and it is difficult for us to monitor that smoking regulations are being observed in lavatories and all, so it would really help us out there if there is a problem with fire.

Once we go over 2 hours, this is where we run into the policing problem that Janis mentioned. If we become policemen there is no enforcement. What happens at the end of the flight, the passenger just walks away and says goodbye. There is no way we can insure that in fact it will be enforced.

We have flights, because we are international, to Japan, for example, where most of our passengers do smoke, so we have to allow for that.

Senator INOUYE. What if you divided the plane into sections, complete units?

Ms. YATES. If you could separate the air flow, like if you had one compartment for smokers, one for nonsmokers, and have two separate sources of air supply so one does not contaminate the other, it would work. As it is right now, there is a great amount of mixing of the air in the same cabin.

Senator INOUYE. Thank you.

Senator KASSEBAUM [presiding]. Thank you very much. My apologies for being late, but I have no questions because it sounds as if it was covered pretty thoroughly. We very much appreciate your testimony. Thank you.

The next panel is Dr. Thomas Stock, University of Texas, School of Public Health; Mr. Bertil Werjefelt, president, Xenex Corp., Honolulu, Hawaii; Dr. Michael Gregg, Centers for Disease Control, Deputy Director for Communications, Epidemiology Program Office, Atlanta, Ga.

Dr. Gregg, since you are somewhat in the middle, do you want to start off?

STATEMENTS OF DR. THOMAS STOCK, UNIVERSITY OF TEXAS, SCHOOL OF PUBLIC HEALTH; BERTIL WERJEFELT, PRESIDENT, XENEX CORP.; AND DR. MICHAEL B. GREGG, CENTERS FOR DISEASE CONTROL, DEPUTY DIRECTOR FOR COMMUNICATIONS, EPIDEMIOLOGY PROGRAM OFFICE, ACCOMPANIED BY RICHARD LEMEN, DIRECTOR, DIVISION OF STANDARDS DEVELOPMENT AND TECHNOLOGY TRANSFER, NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

Dr. GREGG. I would be delighted.

Senator Kassebaum and members of the subcommittee, I am Dr. Michael Gregg, Deputy Director, Epidemiology Program Office, in the Centers for Disease Control [CDC], of the Public Health Service. I am accompanied by Mr. Richard Lemen, on my right, Director of the Division of Standards Development and Technology Transfer, in CDC's National Institute for Occupational Safety and Health [NIOSH].

Thank you for the opportunity to testify on certain potential health problems related to air quality in commercial aircraft cabins.

First, it is important to emphasize that there is very little objective, scientific, and substantive information in the medical literature demonstrating proven health hazards peculiar to either passengers or crew aboard commercial aircraft as it relates to infectious diseases.

The reasons for this are traceable to several possibilities. One, the health problems may be few and not of sufficient medical significance to be reported to health authorities. Two, except for the crew, exposures are relatively short lived and the health problems occurring following such travel would be difficult to attribute specifically to exposure within a commercial airliner. Three, any scientific studies of passengers aboard commercial airlines would be very difficult to perform and the findings likely to be difficult to interpret.

With respect to concern for transmissibility of communicable disease aboard an aircraft, there are several factors that need to be considered.

No. 1, infectious agents. All infectious agents are transmitted either by direct person-to-person contact, contact with infectious objects, animals, or other vectors; through contaminated food or water; or via the air, which I understand is the subject of this hearing.

Person-to-person transmission of disease occurs either by direct contact between infected and susceptible individuals or by spread of the infectious agent by respiratory droplets. These particles arise from coughing, sneezing, and talking and are carried in the air usually no more than 3 or 4 feet before settling on the ground.

In contrast, true airborne infection occurs when the infectious particles become aerosolized into extremely small particles called droplet nuclei that may remain suspended in the air for literally hours before settling. The distinction between these two modes of transmission, droplet and droplet nuclei, is particularly important when trying to establish how a disease is transmitted in a confined, crowded space such as that which would occur aboard a commercial airliner. In other words, although it is possible that infectious particles may become truly aerosolized and spread throughout the cabin by the normal movement of air, disease that may develop among passengers could very well be transmitted through the more direct person-to-person kinds of contact, as described above. Usually it is impossible epidemiologically to definitely answer which mode of spread may produce disease under these circumstances.

Two, the effect of crowding. The essential point is that when people are brought together in confined spaces in fairly high concentrations, this increases the opportunity for transmission of infectious diseases. Medical literature is replete with examples of increased transmissibility of communicable diseases because of crowding, frequent contact, and in some instances, possible airborne transmission.

In summary, then, the epidemiological circumstances of crowding people in a confined space would clearly promote the transmission of an infectious agent if present. As indicated above, a partially or completely filled aircraft cabin in general, would constitute a crowding of individuals. The same would be true for other commercial vehicles such as buses and trains.

Three, detection of disease. Given the frequent circumstance of individuals traveling aboard commercial airliners, what is the likelihood of detecting epidemic disease resulting from the presence of any infectious agent and establishing the mode of transmission? First, one must recognize that all infectious diseases take time to develop signs and symptoms following exposure. This time is called the incubation period and varies from perhaps 12 to 18 hours in the shortest of all incubation periods, up to several weeks or even months in some diseases. With this in mind, then, and the fact that there is usually a fairly wide dispersal of passengers at the end of a flight together, the likelihood of detecting disease among the discharged passengers who may be hundreds or even thousands of miles apart is generally very small. The usual diseases transmitted in these circumstances would be expected to be upper respiratory infections such as the common cold, influenza, and a group of other viral respiratory diseases, most of which are not reported—and generally are not required to be reported—to local health departments by the attending physician. Therefore, these diseases would go unrecognized completely. Only under the most unusual circumstances where the cohort of discharged passengers was recognized as having shared a common airline cabin exposure 1 to 2 days previously or where the disease was extremely severe and or rare would there be a likelihood that the epidemic would be recognized and subsequently investigated by health authorities.

When considering the potential health problems associated with air quality in airline cabins, it would be difficult for me as a health representative not to mention exposure to cigarette smoke. In addition to the known health hazards for the smoker, there are also potential hazards to the nonsmoker. Although nonsmokers in airline cabins are exposed to less smoke than smokers, the smoke to which the nonsmokers are exposed is qualitatively different and may cause significant annoyance or acute adverse health effects in asthmatics and in others with preexisting illness such as cardiovascular disease. The effects of involuntary smoking range from minor eye and throat irritation to aggravation of preexisting heart and lung disease. Further, there is an increasing body of scientific evidence that suggests involuntary cigarette smoke inhalation may increase the risk of developing lung cancer.

In summary, we have no evidence to indicate that exposures to infectious agents and cigarette smoke and its combustible products aboard a commercial airliner differ from those from similar kinds of exposures in other relatively crowded situations. The quality of air should be of concern with respect to keeping it as free of adventitious agents as is practical under the crowded circumstances of aircraft travel.

Senator KASSEBAUM, this concludes my testimony. I would be happy to answer questions you or other members of the subcommittee may have.

Senator KASSEBAUM. Thank you, Dr. Gregg. I think that we will go ahead and hear testimony from the rest of the panel and then come back to questions.

Mr. Werjefelt.

Mr. WERJEFELT. Thank you for the invitation to testify here.

Senator KASSEBAUM. You seem to have come the furthest of those testifying, is that correct?

Mr. WERJEFELT. I guess so.

My statement, as you probably know, is very lengthy, so I think it is best that I take the opportunity to perhaps comment on a few of the things that have come up as we have gone along, so I do not become redundant on the issues.

Senator KASSEBAUM. I very much appreciate that, and the full statement will be made a matter of record.

Mr. WERJEFELT. Thank you.

Comments that were made by the FAA concerning smoke problems on board and whether or not Mr. Beard wanted to use a smoke mask during such circumstances. What was not pointed out by Mr. Beard was the fact that 90 percent of all fires occur in flight and you are at 35,000 feet. You cannot get out of the circumstance at that point.

He was constantly talking about getting out of the airplane. You have to get it down first. We have repeatedly had circumstances where planes are landing full of asphyxiated people. That should be kept in mind when one is discussing whether or not there should be protection for passengers.

There seemed to be some confusion as to the operations of the air-conditioning systems on board and whether or not there is a separate system for pilots, et cetera. The systems that supply the air are the same for crew and passengers. However, the ducting is such that the pilots are supplied air which is first fed into the cockpit and afterward into the passenger cabin.

In other words, the air that has been used in the cockpit is then afterward provided to the passenger cabin. At the same time, clean, fresh air is also fed into the passenger cabin.

To clarify: In a sense, there is a separate system for pilots, in that, the air is different for pilots than for passengers. In other words: 100 percent fresh air for pilots as opposed to passengers receiving the used, or in the case of a cockpit smoke emergency, the contaminated air from the cockpit, mixed with other fresh air from outside and often also mixed with used air from the passenger cabin itself. The machinery is the same, but the systems and methods of supply are different—as are the end results: 100 percent fresh air for pilots and recirculated or contaminated air for passengers.

The problem from a safety standpoint in the cockpit is that if you do have a fire in the cockpit and smoke is emanating from there that smoke is winding up in the passenger cabin and the passengers have no protection, whereas the pilots do.

On the matter of air quality and pressure on board aircraft, we have previously submitted testimony and the FAA is aware of their own internal study done by the senior FAA medical examiner in Honolulu, Dr. Canete, which shows that 6 to 7 out of every 100 air travelers—that is, after the study was computed on a percentile basis, 6 to 7 out of every 100 air travelers with certain ischemic heart disease died 3 to 4 days after air travel.

I would say that certainly is one thing they have totally avoided discussing. It is a problem. It is worthy of study, additional study. That is what the purpose of this bill is all about. The FAA is opposed to it. I cannot understand it. As I pointed out in my prepared statement, it is a very serious statistic.

Just a few thoughts from the ending portion of my prepared statement: The bottom line of what we are discussing here today is a 20th century mode of transportation and the fact that it is the only mode that requires crew and passenger to be encapsulated in a pressure chamber/life support system.

I say that the crew and public has a right in demanding that this life support system be operated in accordance with strict standards and regulations in order to protect public and occupational health and safety. The Administrator of the FAA is objecting to this.

Moreover, during emergency conditions, even though this life support system is many times, tens or hundreds of miles, sometimes hours from the nearest rescue point during which time the occupants are trapped inside, the Administrator is in fact objecting to the provision of state-of-the-art technology that will reduce fatalities and at least give the occupants, crew, and passengers, a fighting chance to survive.

I consider that to be willful and autocratic neglect on the part of the Administrator, who is the only responsible party in the agency under the act.

In response to what was said here by the ATA, by the FAA, that work is going on relative to passenger oxygen masks, I testified previously in the House a few months ago on the matter of the Air Canada disaster. In response to questions there, the Administrator says the FAA is going to do nothing about smoke masks for passengers, even in the face of the 23 fatalities. I do not understand how that squares with what was said earlier this morning by FAA and ATA representatives.

To render perspective on what we are trying to determine, I would like to point out this fact also. In a recent issue of the Los Angeles Times there was an extensive article on air safety. The old, now almost fabled, phrase that it is safer to fly than to drive a car occurred as expected.

I quote: "Plane accidents kill an average of 145 persons a year, while automobile accidents average 132 deaths a day." On the face of it, the old adage appears to be true. However, with a small back-of-the-envelope calculation one will find the following:

First of all, there are more than 130 million cars in this country, and only 4,000 airliners—actually less than that—in our entire fleet.

Back-of-the-envelope calculation reveals that there are 0.03 fatalities per aircraft per year, while, surprisingly, only 0.0003 fatalities per automobile per year. This translates to 1 death per every 33 aircraft per year, as opposed to 1 death per every 3,300 automobiles. By this account, in other words, a determination of how safe are you in any one car or any one airplane, it is 100 times safer to be in a car than an airplane.

I mention this from the standpoint that I think it is important for us to retain our perspective of what is fact and what is fiction. Statistics can be bent in many different ways, but I think we should look very closely at what the true facts are.

My testimony is lengthy and previous testimony on S. 1770 has provided ample information that Senator Inouye's concern in introducing S. 197 is well founded. I think we have all heard that this morning Senator Inouye is greatly deservant of praise, as are the efforts of the other committee members, particularly Chairwoman Kassebaum, for her foresight and thoughtfulness in calling these hearings in order to get to the bottom of the problems.

I thank you for the opportunity to testify. I trust our contributions have been of value to this committee, the Senate, and, most importantly, the public who relies on you for appropriate legislative action to protect their health and safety.

[The statement follows:]

STATEMENT OF BERTIL WERJEFELT, PRESIDENT, XENEX CORP.

Madame Chairwoman, Members of the Committee, Ladies and Gentlemen: My name is Bertil Werjefelt, President of Xenex Corporation. I wish to thank the Committee for the invitation to present our views and findings regarding Senate Bill S. 197, the inquiry into the adequacy or deficiency of airliner health and safety standards and practices.

I have previously testified before this Committee and before the Subcommittee on Investigations and Oversight in the House concerning these matters.

Unquestionably, the public and employees on board airliners have a right to reasonable and meaningful health and safety standards when using our air transport system. Senator Inouye's Bill merely seeks to determine whether or not such rights are being violated and/or ignored. And if so, to what extent and what consequences are the rights being ignored or violated.

Based on the more than a thousand pages of documentation that we alone have submitted to Congress plus the testimony of numerous other witnesses, portions of the questions raised in Senator Inouye's Bill are already answered. In other words, are there problems? Yes, there are serious problems, some with lethal consequences to air travelers.

The FAA on the other hand is opposed to the Bill, opposed to an independent study of these matters. Why is the Administrator of the FAA opposed to this independent study? I contend it is because he has so many smoking guns, so much dirty laundry, such a contrary view to expert opinion and commonsense that it is just not desirable to let the public or this Committee know how bad the state of affairs are with the Administrator's Agency. Note that I say Administrator because under the Federal Aviation Act of 1958, as amended, he stands as the only responsible party. The Act even states that he does not have to listen or heed to other advice. I believe, and I know that many others share the belief with me, that the underlying problem, the reasons we are here today, is that the Federal Aviation Act itself is ambiguously written, whereby interpretation as to the priority of health and safety matters is not clear. In fact, evidence clearly demonstrates that health and safety matters, which should be on the top of the list, are put at the bottom of the list in favor of other perceived priorities on the part of the Administrator. Let me now put some substance behind my words and explain to you how the Administrator of the FAA, our guardian of aviation safety, perceives the problems, comments on the problems, and what he does or doesn't do about the problems, and let me also explain to you what the problems really are.

Point No. 1 of the Bill is to determine the adequacy of certain industry practices and FAA rules and regulations with respect to quantity of fresh air per occupant and the overall quality of air on board aircraft.

This sounds very simply and straightforward. Either you have enough fresh air or you don't. All you have to determine is: What is enough fresh air for the purpose of adequate health and safety protection. When that is done then you determine if, in fact, "passengers and crew are provided enough fresh air". So let's do that now.

Many people in industry as well as the FAA and the public seem to be confused about the matter of fresh air ventilation. Therefore, let me briefly explain.

For us to travel at near the speed of sound in a rarified atmosphere 7 or 8 miles above the face of the Earth, we require a life support system in order to sustain life for crew and passengers. We are, therefore, encapsulated in what is known in the trade as a pressure vessel, that is the airline cabin. A life support system keeps us alive. This life support system is also commonly referred to as "the a/c packs" or "airconditioning packs" but it is, in fact, a very sophisticated life support system. The life support system takes air from outside the aircraft, pressurizes it to an appropriate pressure and conditions it ot an appropriate temperature. It is then introduced into the pressure vessel, the airline cabin (which is also part of the life support system).

In the 1950s it was found that pilots were complaining of respiratory ailments due to recirculation of air on board the airliners. Subsequently, pilots have been provided 100 percent fresh air for health and safety reasons. What this means is that pilots receive from 60 to 150 cubic feet of fresh air per person per minute. This in order to protect their health and safety.

How much fresh air do we receive in the passenger cabin? (For the same health and safety reasons the pilots receive fresh air.) Well, it may shock you to hear this, but on occasion, none. That's right, none. Aircraft are now being designed for the purpose of only providing less than 7 cubic feet per person per minute of fresh air. We have made measurements and found that it varies anywhere from zero to 2 to 3, 5, 6 cubic feet of fresh air per person per minute.

Previously, the FAA has asserted that there was a regulatory requirement of a minimum of 10 cubic feet of fresh air per person per minute for the passengers. Even though I pointed out to the FAA, to the Administrator of the FAA, that this was not true, they still proceeded to tell this Committee after the fact, that there was such a regulatory requirement. Moreover, the FAA has also stated that ASHRAE, the American Society of Heating, Refrigeration and Air Conditioning Engineers had established a standard evidence (a letter from ASHRAE) to this Committee that ASHRAE has not established any such standard contrary to statements made by the FAA to this Committee.

The need for fresh air is clearly demonstrated in the quantity of fresh air provided to pilots. It is well recognized in expert circles that 40 to 60 cubic feet is an appropriate minimum in the confined environment of an aircraft cabin. This has been known for decades. Incidentally, there is no more confined environment that we are confronted with in our daily lives than an aircraft cabin, particularly so from the standpoint of fresh air ventilation i.e., even though you may be traveling in a small confined car, you can at any time stop and get out or roll down the windows for fresh air. This is not the case in an airplane. An air conditioner in a car is a comfort item in contrast to an aircraft, where it is a primary component of the life support system.

We have demonstrated, and we have submitted proof and evidence to this Committee; (we will be glad to submit more if it is required) to the effect there are no meaningful fresh air ventilation standards for the passenger cabins of aircraft. Airlines operate the life support system totally as they choose. Why would the airlines do such a thing? Alas, there is a savings to be had, if you reduce the fresh air ventilation or in other words, reduce the operation of the life support system. What does this savings amount to? Well, reducing it from 20 cfmp, which is the average maximum capacity, down to 5 or 6 or 7 cubic feet of fresh air per person per minute, provides a savings to the airlines of approximately 50¢ in the course of a trans-Atlantic trip, less on a trans-Continental trip and nickels and dimes on a short hop.

We all take for granted that the price of our ticket includes an appropriate amount of fresh air for our health and safety. Such is not the case and apparently the Administrator could care less as his previous testimony concerning matters clearly shows. The files of this Committee contain abundant documentation attesting to this deficiency.

Conclusion concerning (1) quantity of fresh air per occupant and the overall quality of air on board aircraft: The practices, standards and regulations governing quantity of fresh and overall air quality in the passenger cabin of airlines is unhealthy, unsafe, undesirable and unacceptable. There are no meaningful standards or regulations under the operating rules of the Federal Aviation Regulations Part 121 which dictate specific minimum quantities of fresh air for the occupants in the passenger cabins of airliners. Existing rules under part 121, the operating rules, addressing air quality are, first of all, questioned if they even apply, to any of the aircraft in our jet fleet. If, as the FAA entones. Part 121.219 is applicable to, for instance, current production models of Boeing, Lockheed and Douglas aircraft, then the FAA minimum standard for carbon monoxide is more than 5 times higher than the 8 hour standard established by the U.S. Environmental Protection Agency for the general population. The phrase "suitably ventilated" which appears in Part 121.219 provides a subjective interpretation and is, therefore, not a specific minimum standard or regulation. Nevertheless, this may be a moot point since this rule may not even be applicable to modern day jet aircraft.

Senator Inouye's Bill seeks to determine the adequacy of certain industry practices and FAA rules and regulations with respect to quantity and quality of humidification. (Point No. 2)

As explained earlier, the life support system on board aircraft takes air from outside the aircraft, pressurizes it, regulates the temperature and introduces it into the cabin for the survival and comfort of passengers and crew members. Air which is taken from outside the aircraft is virtually devoid of any humidity because of the low pressure and temperature at which it is extracted from outside the aircraft. Therefore, unless an aircraft is equipped with special humidification equipment, essentially all the moisture on board is the perspiration, breath and other moisture from the occupants on board. The higher the fresh air ventilation rates are, the lesser the percentage will be of sweat and breath, etc, from the occupants on board. So, what is going on in practice? Believe it or not, we the passengers wind up being "the special humidification equipment". By reducing the fresh air ventilation to an absolute minimum, the moisture on board will increase. The way this is accomplished is by recirculation. At current fresh air ventilation rates on board aircraft it is not unusual to find that up to 95 percent of the moisture on board is the unsterilized recirculated sweat and breath and germs, if you will, of the occupants on board.

There are no Federal Aviation Regulations that dictate how you should humidify an aircraft; whether with clean water, sweat, breath or whatever else is available. And again it seems the Administrator of the FAA really doesn't care. Or, is it so that he doesn't want the public to know of the deplorable conditions? Nevertheless, he is doing nothing to correct them. Nor does he support this Bill and its investigations into the matter.

Conclusion to (2) quantity and quality of humidification: The quality of humidification (which is a consequence of the operation of the life support system) is, based on current practices, unhealthy, unsafe, undesirable and unacceptable. It has been determined that healthy levels of relative humidity range from 40 percent to 60 percent. However, this determination is based on a natural occurrence of moisture in our daily environment at sea level and is not applicable as a criteria relative to the current practices of humidifying aircraft.

No. 3 of Senator Inouye's Bill is to determine the adequacy of certain industry practices and FAA rules and regulations with respect to air contamination limits.

There are two types of contamination of an aircraft cabin. First, that which is caused by outside sources, in other words, air ingested from outside the aircraft which is contaminated by, for instance, exhaust fumes from other aircraft while on the ground or in the air; ozone contamination which is also ingested from outside into the aircraft while flying (although there is also some question as to how much is actually generated on board aircraft).

Second, the other sources of contamination are those which are generated on board the aircraft. There are, in fact, two categories of contamination. That which is generated by the occupants on board and that which is generated by materials of the aircraft structure or cargo and luggage. Then, of course, there is also contamination resulting from smoke and fire during emergency conditions which I will cover under point number 4 of the Bill.

This Committee has already received ample evidence of the alarming circumstances which exist on board aircraft, in large measure caused by the deplorable fresh air ventilation rates, or I should say the substandard operation of the life support system. For example, measurements have been made on board the aircraft showing reduced oxygen levels to the point of 19 percent when it should be 21 percent (actually 20.95 percent). In practical terms, this means there is a 7 percent contamination of the air on board the aircraft. Seven percent carbon monoxide in air is lethal, so is 7 percent carbon dioxide and 7 percent methane in air is explosive! Precisely what the contamination is, we have not determined. We know for one that a large part of it is carbon dioxide. We have made repeated measures that demonstrate this. What are the consequences of excessive carbon dioxide levels? When they are high enough they are as I said, lethal to anybody, however, at other lower levels a healthy college athelete may feel some discomfort while at the same time a person with ischemic heart disease may die from it. Not necessarily right away, but some short time, or a few days, after the exposure. Moreover, looking at the air contamination problem one must also consider that in many cases, exposure to the contaminants does not involve normal air pressures. It occurs in a rarified atmosphere, the equivalent sometimes of 8 or 10,000 feet altitude. It is well known that effects of contaminants on man, at other than normal pressures, may be dramatically escalated.

Because of reduced fresh air ventilation rates on board aircraft, in other words, reduced operation of the life support systems, there are dramatic increases in virus, fungus, bacteria and such micro-organisms. How big is this problem? By way of example, this Committee was told last year that if one sampled the air in the room, one may at worst expect to find 1 or 2 bacteria colonies on the sampling dish. What is being found in aviation? By merely making a few random tests, I stress not searching high and low, just a few random tests—the bacteria colony count has been found to be as high as 250!

Dr. A. J. Clayton, Dir. of the Laboratory Center for Disease Control, of Ottawa, Canada, who has studied disease transmission on board aircraft, concludes that there is "a significant risk to other passengers of acquiring a highly transmissible disease such as Lassa fever, Marburg, Ebola virus disease or Smallpox". We have evidence of chickenpox being spread on board aircraft. The Center for Disease Control has documented a case where influenza was spread on board an aircraft. The disease transmission rate was 72 percent. In other words, one individual infected 72 percent of the other crew and passengers on board. Therefore, on a large aircraft such as a jumbo capable of transporting 400–500 passengers, it is possible that one individual could infect more than 300 of the other passengers on board, principally because of the deplorable fresh air ventilation. The interesting observation vis-a-vis the CDC case is that the plane in question was parked on the ground, with the air conditioning equipment inoperative, which meant that the aircraft was being ventilated at a low rate from outside, partly because of the low external temperature (Kodiak, Alaska). Current fresh air ventilation rates on board aircraft in the passenger cabin are low to nil, ranging from zero to 6 or 7 cubic feet per person per minute of fresh air. The acknowledged borderline suffocation level is on the order of 4 cubic feet (noticeable medical symptoms).

Again, what is the Administrator's reaction to this? He doesn't care. He certainly has not done anything to demonstrate that he cares. Nor does he want this Committee to authorize and independent study to investigate the matter. We can only ask, why? Is there someting there he doesn't want us to know about?

Conclusion concerning (3) air contamination limits: Currently available information clearly shows that there are problems and a conspicuous absence of appropriate standards and regulations. Even cursory investigation reveals that the problems are bigger than first thought. The need for further study and corrective action is obvious.

No. 4 in Senator Inouye's Bill also seeks to determine the adequacy of certain industry practices and FAA rules and regulations with respect to emergency breathing equipment, including toxic fume protective breathing equipment.

Now that seems rather clear cut. Everybody knows that every pilot and passenger on board aircraft is provided an oxygen mask. What most people don't know is that the passenger oxygen mask on board aircraft is useless for the purpose of toxic fume protection; the pilots are in most cases, instructed not to even deploy them. Not because the oxygen would fuel a fire because there is so little of it there, but because they are plain useless. The passenger oxygen masks only provide a few minutes, and I stress a few minutes, of supplementary oxygen. Most of what is inhaled through the mask is the ambient cabin air, which in the case of a smoke emergency is filled with smoke and toxic fumes! Let me quote to you the exact emergency instructions for the pilots (from the operating manual of one of our popular airliners): "It is not recommended that the passenger oxygen masks be deployed when excessive smoke is in the passenger cabin. The passenger oxygen masks are not smoke masks and were not designed, tested or certified to serve this purpose. These masks supply a breathing mixture which consists primarily of cabin air, admitted through an inlet valve in each mask, and a relatively small amount of pure oxygen from the cabin oxygen distribution manifold. Thus, in a smoke-filled cabin, any noxious fumes would be inspired directly into the passenger oxygen masks, and the small amount of manifold oxygen present would provide no significant displacement or dilution of toxic agents."

So, if pilots are told not to deploy the oxygen masks because they are useless for smoke protection, why is the public told these oxygen masks are not deployed for fear of fueling a fire? Is this a smokescreen? Yes. Although flight personnel, as well as FAA personnel, and the vast majority of the public believe that they are afforded protection by the passenger oxygen masks, the Administrator of the FAA is doing nothing to dispel this mistaken belief. Nothing. He won't even demand there be emergency instructions for passengers, telling them what to do during in flight fire, smoke and toxic fume emergencies! Why? Is it because the public and airline personnel would then become wise to the fact that the protection we thought (led to believe?) was provided all along, literally taken for granted, is in fact, not even there?

The Air Canada disaster, 5 months ago, (which is just another disaster like the ones that keep occurring with unnerving regularity) demonstrates the need for toxic fume protection for the passengers. FAA has known about the problems for years, decades as a matter of fact. What is the Administrator doing about it? In other words, what protection is there against the toxic fumes that can eminate from burning interiors, leaky cargo or luggage—absolutely nothing. What does he think should be done? A year ago his comments to the proposed study by Senator Inouye was, and I quote: "In closing, I wish to reiterate that the FAA has thoroughly reviewed the issues raised by S. 1770 and I am satisfied that the current standards relating to the issues are adequate. We do not support the independent study called for by the Bill and . . .". That was before the Air Canada disaster. After there have been 23 people asphyxiated literally on the front door of the FAA, (and there are continuously tragedies of this sort, a notable recent one was in Riyadh, Saudi Arabia where 301 people were asphyxiated.) What does the Administrator say?

As I mentioned earlier, I testified for the Subcommittee on Investigation and Oversight in the House a few months ago concerning the Air Canada disaster. In response to written questions, from I believe Congressman Levitas, Administrator Lynn Helms of the FAA says "We do not find a need to provide protection for passengers beyond the oxygen masks presently provided . . ." He also says he intends ". . . to take no action on requiring or developing passenger protective breathing devices." Is this what we expect to hear from the Administrator of the FAA, the person whom we indirectly entrust our life safety to, who is supposed to be looking out for crew and passenger safety? His statements are an utter embarrassment and a disgrace to the many loyal and dedicated people within the FAA and industry, who are trying hard to improve aviation safety.

The SAFER Committee, comprised of 150 of the world's top experts in aviation systems and safety, recommended 3 years ago that immediate action be taken to evaluate toxic fume protective breathing devices. The Flight Safety Foundation, an organization to which literally every airline in the world belongs (and many other affiliated organizations, i.e., insurance companies, etc.) recognize the need for toxic fume protective breathing equipment, and have stated so. In short, all the experts recognize the need. So do the non-experts. One must seriously question what Mr. Helms' motives are for defying expert recommendations, expert opinions and commonsense. If he had been on the Air Canada flight would he have liked to have some toxic fume protection? Whatever the Administrator's dimwitted motives are, believe it or not, the Federal Aviation Act permits such action as it is presently written. The Administrator doesn't have to listen or answer to anybody except, I assume, the Secretary of Transportation and the President, and I would, of course, hope this Committee or Congress. But why should it have to take an Act of Congress to force the Administrator to attend to what appears to be his basic duties, which we have entrusted to him to care for.

Conclusion (4) emergency breathing equipment including toxic fume protective breathing equipment: Full knowledge exists of the compelling need for toxic fume breathing equipment for all crew and passengers. Pilots are protected by regulations and equipment. None is provided for passengers and cabin crew. Hundreds, if not thousands, of fatalities attest to the need, not only for equipment and regulations but also emergency instructions. Present provisions (or rather, lack thereof) for life safety are outdated, unsafe, unacceptable and unjustifible.

Senator Inouye's Bill also seeks to determine the adequacy of certain industry practices and FAA rules and regulations with respect to measures procedures and capabilities for extinguishing fires and the removal of smoke and toxic fumes within safe pressurization limits.

Again, we have just had a disaster where 23 people paid with their lives because of inadequate procedures, non-existent smoke protection and shockingly inadequate fire fighting equipment.

Because of the toxicity of even the best fire extinguishers when used in a confined environment of an aircraft cabin, and particularly so in aircraft cabins at reduced pressures, there is virtually no meaningful fire extinguishing equipment available in the passenger cabin of an aircraft, in contrast to what we are used to in our daily environment. I submitted data to this Committee before which shows that there are more than 600 occurrences of fire, smoke, fumes and explosions on board U.S. aircraft every year.

Moreover, 90 percent of all aircraft fires occur in flight where we are totally helpless. We have no way of escape. In some cases, the nearest escape may be 30 minutes away; in some cases a couple of hours because of the inability to safely land the aircraft. In the case of Air Canada, they were very close to a suitable airport to the good fortune of those who were lucky enough to survive.

In order to effectively fight the fires, one needs effective and meaningful fire extinguishing equipment. In the passenger cabin of a jumbo jet today you will find approximately the equivalent of 2 small buckets of water and 1 or 2 chemical extinguishers. This is in excess of FAA regulatory requirements!

There is no effective source of water on board. We have no way of escape. We cannot open the windows. We cannot call the fire department for help and protection of many hundreds of lives on board. Under these circumstances it would be charitable to even imply that the existing fire extinguishing equipment amounts to anything even resembling and adequate facade. What the Administrator considers adequate is an insult to any intelligent being. As I said before, there are good reasons for the absence of meaningful fire extinguishing equipment because the fire extinguishing components are toxic to humans, especially in the confined environment and low pressures of an aircraft cabin. In order to fight a fire effectively, you need effective fire extinguishers but you also need toxic fume protective breathing equipment to protect you from the fire extinguishing components, as well as smoke and toxic fumes eminating from the fire.

As it concerns smoke evacuation within safe pressurization limits there are presently regulations for pilots for very obvious reasons. First and foremost to enable pilots to see their instruments and to see outside the aircraft. By regulation they already have toxic fume protection and, although outdated and inadequate, at least some respiratory protection against smoke and toxic fumes.

Unfortunately, the regulations and equipment governing smoke evacuation are inadequate. This has repeatedly been demonstrated-most recently in the Air Canada disaster where the pilots virtually could not see a thing. There are, however, technical solutions to the underlying objective of providing pilots with visibility outside the cockpit as well as the ability to see instruments inside the cockpit no matter how much smoke is in the cockpit. Xenex Corp, has successfully conducted proprietary research and development work in this area. Likewise in the area of improved methods of smoke evacuation.

Nevertheless, to address the current problems, relating to in flight fire and smoke emergencies, anyone who entertains the notion of building a fire proof airplane and concomitant therewith expects to be able to evacuate all smoke and toxic fumes on our present aircraft, is in a dream world grasping after straws, in other words searching for a panacea or building jet age Titanics.

In short, the public mistakenly believes there is protection, meaningful protection, not a facade. Not only the public but many crew and FAA personnel as well believe, for instance, that there is protection afforded by the oxygen masks against the toxic fumes and that there is adequate fire extinguishing equipment on board. This is taken for granted. I submit that this trust that crew and passengers are bestowing on the Administrator of the FAA, is being abused, even beyond the point of deception. Why do I say this? For the simple reason that the Administrator of the FAA won't even go to the trouble of providing instructions for passengers of what to do during in flight fire, smoke and toxic fume emergencies. Why doesn't he do it? Is it perhaps because the public believes they are protected? Because it is taken for granted by almost everyone? So, why, as I said before let the public "become wise to the fact that the protection we thought (led to believe?) was provided all along, is in fact, not even there. . ."

One must ask a simple question. When we provide more protection against fire, smoke and toxic fumes for one or two individuals in their daily environment, (in their home, apartment, office, car, train, ship, etc.) than what is collectivly provided for 500 people in an airliner cabin and, when in an airliner cabin we are sitting on top of tons of explosive fuel, when the nearest point and time when and where you can escape or be rescued is anywhere from 7 miles straight down to many hundreds of miles away amounting to 20, 30, 40 minutes or perhaps hours away with virtually no protection, isn't then something wrong, inequitable, or upsidedown? Certainly. We all know that, but does the Administrator? He considers this to be appropriate!

Think of it. A couple buckets of water and a couple of small hand held extinguishers and no toxic fume protection. 23 people died needlessly in the front yard of the FAA. Five months have passed since the Air Canada disaster. I submit, unless this Committee, or Congress does something, or unless pressure is put on the Administrator's superiors the Secretary of Transportation, Elizabeth Dole, and/or President Reagan, nothing is going to be done. There are not going to be any instructions on planes for passengers of what to do during fire, smoke and toxic fume emergencies, nor will there be any meaningful protection.

Conclusion (5) measures, procedures and capabilities for extinguishing fire and the removal of smoke and toxic fumes within safe pressurization limits: This area of aviation safety is appallingly deficient. This fact has been repeatedly demonstrated in numerous disasters. In the most recent Air Canada disaster the loss of the lives of 23 people stand as grim testimony of the deficiencies. A few years preceding this, 301 people in one single disaster needlessly lost their lives-even more shocking evidence of the deficiencies.

The Administrator of the FAA not only appears to be, but is also clearly on the record, of not wanting to provide the obvious and necessary regulatory measures which would mandate to provide meaningful protection i.e. appropriate fire extinguishing equipment and concomitant therewith respiratory protection for all crew and passengers.

The technology to immediately and effectively accomplish positive change is eminently available at a cost to the traveling public of less than a dollar per ticket. In other words, an acceptable cost for any traveler for his or her life safety protection. Based on available information and evidence, current standards, regulations and practices are unsafe, unjustifiable and negligent. The immediate need to study corrective actions is painfully evident.

Point No. 6a of Senator Inouye's Bill is to determine the adequacy of certain industry practices and FAA rules and regulations with respect to safe pressurization.

Again, on the face of it, this issue seems to be simple and straightforward. Either you have adequate pressure or you don't. So, all you have to do is determine what is the definition of adquate and appropriate pressurization. Unfortunately, however, it is not quite that simple. What is still appropriate and healthy for a college athlete may be lethal to the infirm and elderly. There are no regulations under the operating rules. Part 121, of the Federal Aviation Regulations which bars a pilot from providing a cabin altitude of, for instance, 12,000 feet. Commonly the cabin altitudes are maintained between 5,000 and 9,000 feet. However, I have personally made measurements in excess of 10,000 feet.

Any physician can ascertain the deleterious effects on, for instance, a patient with cardiopulmonary problems. To bring such a patient from sea level to, for instance, 8,000 feet may result in lethal consequences for the individual. Moreover, contaminants such as carbon monoxide or carbon dioxide, in the presence of a low pressure environment, will, as I mentioned before, further aggravate the situation.

I cannot stress and repeat often enough the fact that when we are flying, we are incased in a pressure chamber. We are kept alive by means of a life support system attached to this pressure chamber (actually the pressure chamber is part of the life support system). It is my belief that even the American Medical Association has been led to believe that there are strict and appropriate standards for the operation of the life support system when, in fact, the contrary is true. There are virtually no meaningful standards or regulations. Aside from the fact that certain individuals would become cognizant of their own physiological malfunctions, if the pressure was lowered, and perhaps not even understand why they were feeling sick or tired or were having trouble breathing, the only other indication and where there appears to be some regulatory requirement is that the passenger oxygen masks are supposed to be automatically deployed when the cabin altitude reaches 14,000 feet. There are also some regulations which are essentially directed to non-pressurized aircraft, requring oxygen for passengers when operating above 12,500 feet.

Nevertheless, maintaining safe pressurization during flight and having standards and regulations to this effect which take into account the health of the general population, (not a college athlete or green beret) would not only appear to be prudent but an obligation of the Administrator, particularly since most of the population of this country fly at one time or another during the year and, I am informed that ⅓ of all air travelers are over 60 years old.

Conclusion (6a) safe pressurization: A need to study and determine the appropriate safe pressurization levels which are applicable to the general population appear to be obvious. Moreover, whatever such levels are determined to be this information should be widely diseminated to the medical community in the interest of public health and safety.

Point No. 6b of Senator Inouye's Bill seeks to determine the adequacy of certain industry practices and FAA rules and regulations with respect to means for collecting and disseminating a data base of medical statistics relating to air travel in an effort to assess the adequacy of aircraft systems, design, regulations, standards and practices from a health and safety standpoint, for the purpose of issuing appropriate

FAA administrative advisory circulars and airworthiness directives to correct any deficiencies disclosed.

In light of what we have already learned relating to the near complete absence of regulations, standards and acceptable practices concerning the operations of the life support systems; the fact that communicable diseases are spread on board airliners at an apparently alarming rate under certain circumstances and many other medical matters which previously have been detailed to this Committee (not to be forgotten are viruses and colds), all of this would justify a study for the purpose of establishing means for collecting and disseminating such data.

To these who question or oppose this justification, let me add that a study conducted in 1976 by a Senior FAA medical examiner in Honolulu reveals that on a percentile basis 6 to 7 out of every 100 air travelers with certain ischemic heart disease, as defined in the study, die not necessarily while they travel but rather within 3 to 4 days after air travel. Moreover the study was limited in its scope—essentially a pilot study which had as its genesis the simple observation that 81 out of 232 cases of myocardial infarction were tourists to Hawaii. In other words, approximately 35%. At any one time the tourist population in Hawaii only accounts for 3 to 4% of the resident population.

Since the almost exclusive mode of transportation to and from Hawaii is a long jet flight, it was presumed that this fact was in some way contributing to the exceedingly high rate of tourist patients for cardiac care. The study does not disclose how many of the resident patients (65%) had flown within a certain time and were admitted for cardiac care. Therefore, the number of fatalities per 100 could in fact, be twice as high. Such percentages, as are evident in this data, are of statistical significance and are on the same order of magnitude as those that alerted the medical community of toxic shock syndrome.

Conclusion: (6b) FAA in some instances claim non-jurisdiction concerning health of air traverlers. This may or may not be legally correct under the interpretation of the Federal Aviation Act. Nevertheless it would appear that the health and safety of air travelers is FAA's responsibility since the agency takes responsibility or nonresponsibility, as it may be, for the operation of the life support systems.

Be it as it may, this Committee's records and that of other Congressional Committees and, I believe if you dig hard and deep enough, the files of the FAA, all contain ample testimony and evidence to justify not only serious and extensive studies but, some form of immediate measures based on what already is known.

The bottom line is: Jet travel, the 20th century mode of transportation requires crew and passengers be encapsulated in a pressure chamber/life support system. I say the crew and public has a right and demands that this life support system be operated in accordance with strict standards and regulations in order to protect public and occupational health and safety. The Administrator of the FAA is objecting to this. Moreover, during emergency conditions, even though this life support system is many times, tens or hundreds of miles, sometimes hours, from the nearest rescue point, during which time the occupants are trapped inside, the Administrator is, in fact, objecting to the provision of state of the art technology that will reduce fatalities and at least give the occupants—crew and passengers—a fighting chance to survive. Such wilful neglect and autocratic action by the Administrator cannot, should not, and will not be tolerated.

Before I close I wish to leave you with two items of interest. One, relating to the aviation safety record and the other FAA policy.

The aviation safety issue: In a recent issue (September 11) of the Los Angles Times there was an extensive article on air safety. The old, now almost fabled phrase that it is safer to fly than to drive a car occurred as expected. I quote ". . . plane accidents kill an average of 145 persons a year, while automobile accidents average 132 deaths a day." On the face of it the old adage appears to be true. However, with a small back of the envelope calculation one will find the following. First of all, there are more than 130 million cars in this country and only 4,000 airliners in our entire fleet. The back of the envelope calculation reveals that there are .03 fatalities per aircraft per year while surprisingly only .0003 fatalities per automobile per year. This translates to one death per every 33 aircraft per year and one death per every 3300 automobiles per year. By this account, in other words, a determination of how safe are you in any one car of any one airplane, it is 100 times safer to be in a car than an airplane.

As to FAA policy on aviation health and safety, it is evident to all that this witness is cynical and has concluded that it appears the Administrator's policy amounts to this: What are the minimum safety measures, and, conversely maximum fatalities and injuries the agency can get away with without getting caught and still maintain the public trust. One would have thought that such attitudes and practices were abolished or extinct in this day and age. Apparently not.

Although my testimony is lengthy, it still only shows you the tip of the iceberg. Senator Inouye's concern in introducing S. 197 is well founded and certainly deservant of praise, as are the efforts of the other Committee members particularly Chairwoman Kassebaum for her foresight and thoughfulness in calling these hearings, in order to get to the bottom of the problems.

I thank you for the opportunity to testify and I trust our contributions have been of value to this Committee, the Senate and, most importantly, the public who relies on you for appropriate legislative action to protect their health and safety.

I will be pleased to answer any questions the Senators may have.

Senator **Kassebaum**. Thank you very much.

Dr. Stock.

Dr. **Stock**. Good morning, Madam Chairman, Senator Inouye. I am Thomas Stock of the University of Texas School of Public Health in Houston. I would like to thank the members of the Subcommittee on Aviation for allowing me the opportunity to provide testimony regarding the merits of the proposed study of aircraft cabin air quality which would be required by S. 197.

My areas of professional interest include measurements of environmental contaminants, industrial hygiene, and assessment of human exposure to air pollutants. During the last 4 years I have been actively involved in three separate research studies concerning the characterization of indoor air quality in residences and the assessment of exposure to indoor pollutants.

I concur with the opinion of Dr. Charles Billings and others expressed during last year's hearings on S. 1770 that there is an almost complete lack of available and reliable data concerning the characterization and potential human health effects of the air quality inside commercial jet aircraft. Much of the controversial discussion at this hearing could be eliminated if such a data base existed.

It is difficult for me to appreciate the position taken by the FAA and the ATA that further study is not necessary. The absence of data indicating a problem with airline cabin air quality is not very convincing when due to the absence of any relevant data at all.

A similar situation existed about 15 years ago when air pollution specialists were convinced that the indoor environment was universally protective against air pollutants. Thanks to a few inquisitive early investigators and much recent research, we now know that the concentrations and variety of air contaminants inside structures may be much greater than those measured in the outside ambient air.

Sources of elevated concentrations of pollutants indoors include combustion processes such as cooking, smoking, use of consumer products, level of human activity and kinds and amounts of building materials and furnishings. Source factors may be further enhanced by energy conservation measures affecting overall air infiltration.

It seems reasonable to expect that the methods and approaches used in evaluating air quality in homes and offices would be applicable to airliner cabins. There is a variety of portable air monitoring equipment that would be appropriate for such a study.

I would recommend that an extensive and in-depth investigation of the types, sources, quantities and behavior of air pollutants inside commercial jet aircraft be undertaken. At the same time, appropriate human response data should be obtained in order to investigate possible associations between exposures and adverse health effects.

At this time I would like to refer to something that was stated earlier in the testimony about the 1971 report. I have not had an opportunity to review that report, but the fact that it was published should not necessarily give it any more credibility.

It has not, to my belief, been published in the open scientific literature, subject to peer review, and as perhaps my colleagues at CDC and NIOSH will attest, not every Government publication that is available through NTIS is without flaw.

It appears that the only recent airline industry attempt to study air quality inside aircraft is the United Airlines study performed during the summer of 1982. I was asked by the Association of Flight Attendants to critically review the report of the study entitled "Aircraft Cabin Air Quality Study." The remainder of my testimony is a brief summary of the major points of my critique of this study.

The United Airlines study report revealed serious deficiencies in three major areas—sampling strategy, monitoring methodology, and interpretation of data. The intent of the study was not well focused. The sampling design was too limited for a major study and inappropriate for a pilot study.

Aircraft sampling was not representative and the selection of pollutants to be monitored was not adequately justified. Important temporal and spatial aspects of air sampling were not considered. Most of the monitoring methods employed were inappropriate for sampling an uncharacterized dynamic environment. Several methods did not provide adequate sensitivity.

The effect of the extremely low relative humidities inside the aircraft on the measurement methods was not considered. Lower humidity limits of several methods were often exceeded. Incomplete or inaccurate information concerning sampling devices and analyses appeared frequently in the report. Many reported results were actually less than the established lower detection limits of the methods. Data inconsistent with stated sampling conditions were also observed.

Problems with the interpretation of the data produced in the study go beyond the clear failure of assuming valid and representative results. In evaluating the effects of the measured air quality, only occupational standards were considered. It is entirely inappropriate to evaluate passenger exposures by comparison to occupational standards because of differences between working groups and the general population.

The passenger population may contain persons who may be more susceptible than the average worker to the effects of air pollutants—for example, infants, the elderly, pregnant women and those with preexisting diseases.

Comparison of the reported monitoring data to relevant EPA ambient air standards reveals a number of measurements near or even exceeding these standards. Although cigarette smoke is an obvious major source of air pollution inside commercial aircraft, it was not adequately addressed in the study. The most important size range of particles from smoke was not measured, nor were potential irritants from tobacco combustion.

The report's attempt to characterize cigarette smoke as nuisance particulates is very misleading. There is an abundance of scientific literature attesting to the fact that cigarette smoke is not biologically inert. Acute exposures are known to elicit irritation of the mucus membranes, allergic responses, and aggravation of asthma, among other effects. Chronic responses to exposure may include bronchitis, emphysema, and cancer.

Thus, the exposure of nonsmoking passengers and crew to cigarette smoke in the closed environment of the aircraft is a serious health concern deserving careful attention and evaluation.

This completes my prepared statement. Again, if I could just refer to a previous recommendation of the ATA, that they did not seem to oppose a study of the biological environment of aircraft. I do not see any reason why we should not do a complete study that would evaluate the chemical, physical, and biological quality of the environment inside aircraft, in light of the deficiency of data.

Thank you very much. I would be willing to answer any questions.

Senator KASSEBAUM. Thank you very much, Dr. Stock.

It seems really very clear that the lack of a good data base is seemingly thwarting any good efforts to analyze what is taking place. I would like to ask you, Dr. Gregg, am I correct in assuming from your testimony that you believe actually there is no disease transmission necessarily in the plane, that the atmosphere there is not particularly different than would be found in a large congregation anyplace else?

Dr. GREGG. Well, we have no evidence to state whether it is particularly different or not. What I am really trying to get across is the point that it is a crowded area of people and they are sharing air, and in that broad sense—the epidemiological sense—it really does not appear on the surface, at least as far as we can tell, to be any different from if you put a lot of people in a bus.

I am not trying to say they are the same. I am just saying that when you put a lot of people together, when they are sharing air, epidemiologically this is a kind of similar group. Then you have to look at the factor of what kind of air are they sharing and is it indeed the same. That is the point I am trying to get across.

Senator KASSEBAUM. But is it the same? I guess I would ask that because you are at a different altitude, say, than in a bus.

Dr. GREGG. Yes. I am not able to tell you what differences there might be because one is at an 8,000-foot pressure versus sea level, as to whether this makes any difference in terms of communicable disease transmission. I doubt that there is any information on that.

Senator KASSEBAUM. Do any of you as panelists have any suggestions to make as far as what would be the best measure, way to measure for the necessary information that we need to get on the data? Dr. Stock?

Dr. STOCK. If I may address that, I think that to accurately answer that question would take some sort of feasibility study. I think there are many potential pollutants that may be of concern in the environment of the cabin air, and I think that perhaps a preliminary feasibility study would be the best way to determine which are the most important pollutants and the most appropriate kinds of measurement methods.

Senator **Kassebaum**. I guess what I was wanting to know is—because I do not know—what type of equipment is necessary to do this.

Dr. **Stock**. Well, the type of equipment necessary is available and it comes from the field of industrial hygiene where easily portable personal monitoring equipment is used routinely, so I do not see any problem with using this type of equipment. It is the same kind of equipment that we have used to evaluate other indoor environments.

Senator **Kassebaum**. And it could be used the same without any adjustment?

Dr. **Stock**. There may be a few monitors that might not be able to be used because of potential problems with combustible gases, but there are other adequate substitutes available.

Senator **Kassebaum**. Is this expensive?

Dr. **Stock**. Well, most scientific equipment is somewhat expensive, but the portable devices tend to be much less expensive than the equivalent monitoring equipment that is used by EPA for ambient monitoring, for instance.

I cannot give you off the top of my head what a total cost of having all the equipment necessary for monitoring would be, but in light of the necessity for establishing this data I do not think it would be an onerous burden.

Senator **Kassebaum**. Mr. Werjefelt, did you have any comment?

Mr. **Werjefelt**. Presently there are no standards existing for the general population for indoor air quality per se. They are just evolving. But at the same time, there is literally nothing on the books which concerns an 8,000-foot environment and the effects of carbon dioxide, for instance, at that altitude on the general population.

So I can say from one standpoint it would be a long, tedious process to really get to the bottom of the problem of what are the acceptable minimum fresh air ventilation standards and the maximum contamination levels in the cabin. Obviously they need to be studied.

Senator **Kassebaum**. Were you suggesting in your testimony it would be a good idea for everyone to have masks available?

Mr. **Werjefelt**. Strictly on the basis of an emergency, if you had a fire on board, you need smoke protection.

Senator **Kassebaum**. Other than the type of masks that are already there, the oxygen masks?

Mr. **Werjefelt**. Those are useless as smoke protection. They would not even be deployed.

Senator **Kassebaum**. So you would have to have another type of mask that would drop down similar to the oxygen mask?

Mr. **Werjefelt**. As an interim measure you have another dropdown mask. There is plenty of space for it. It weighs very little, provides an unlimited amount of fresh air. In future developments of it you can combine two features, fresh air and oxygen, into one. But in order to provide meaningful protection, you cannot use just an over-mouth mask. That problem was even apparent with the masks that the Air Canada pilots were using. You need a hood.

The Civil Aeromedical Institute and various other organizations have determined that. Therefore, as I see it now, they want to combine the features of oxygen for decompression and fresh air for smoke protection into one unit. So, the mask you will see 3, 5, or 10 years from now may look quite different from the one you are used to, the one they usually demonstrate to you.

Senator **Kassebaum**. But you think for an interim there should be two?

Mr. **Werjefelt**. Unquestionably. Otherwise there will not be any protection against smoke and lethal fumes.

Senator **Kassebaum**. And you would have to have a separate unit, though, for fresh air that would be supplied to those masks, is that correct?

Mr. **Werjefelt**. No, fresh air is already being supplied in the ducting system. On 80 percent, approximately 80 percent of the entire fleet, there is a fresh air outlet within reach of each individual, that little nozzle that everybody keeps turning from time to time.

Senator **Kassebaum**. Trying to turn it off usually.

Mr. **Werjefelt**. That outlet will supply fresh air to you. The pilot can control that with a switch. Sometimes there is recirculated air coming through the duct system. All the pilots need to do is turn off the recirculation.

Senator **Kassebaum**. And it would flow then into the mask.

Mr. **Werjefelt**. You would just hook the mask up to it, or it automatically deploys. That way you can get protection on the market now rather than 10 or 15 years from now.

At the same time, there are some aircraft that do not have fresh air outlets. They are being dispensed with on larger aircraft—newer models. To install an automatic drop-down system, for example, on a DC–10 would involve about 40 man-hours worth of work—something that can be accomplished during an ordinary servicing of aircraft. It is very simple to do.

Senator **Kassebaum**. Thank you.

Senator Inouye?

Senator **Inouye**. Thank you.

I gather that at the present time the FAA has the sole jurisdiction over determination of what is proper in the health and safety areas for flight attendants.

Do you think OSHA should get into the act, or CDC, or the Public Health Service?

Dr. **Gregg**. I think maybe Mr. Lemen might answer that, representing NIOSH.

Mr. **Lemen**. Might I just say that we have been involved with flight attendants through our health hazard evaluation program, and we are actively working now on a study of the health status of flight attendants, primarily looking at pulmonary function decrements and respiratory problems, as well as the potential for cancer in flight attendants. The study is ongoing at the present time.

Senator **Inouye**. Do you have the authority to set standards?

Mr. **Lemen**. The National Institute for Occupational Safety and Health has only the authority to recommend standards to the Occupational Safety and Health Administration.

Senator INOUYE. So in the final analysis, FAA is the one that makes the decision?

Mr. LEMEN. I cannot answer that question for sure. I do not know if OSHA has total jurisdiction or if FAA has total jurisdiction, but I do know that under the Occupational Safety and Health Act OSHA would have some authority in protecting the work environment of flight attendants, but I do not know exactly how much authority that is as compared to the FAA.

Senator INOUYE. The impression I gather is they have none.

Mr. LEMEN. That may be true. I cannot answer that question.

Senator INOUYE. The organization is back there.

Does OSHA have any jurisdiction?

Ms. YATES. The minute you get on the airplane their jurisdiction stops because you are considered under the FAA on the aircraft. If you were hurt inside the terminal, that might be OSHA, but on the airplane itself, it comes under FAA very clearly.

Senator INOUYE. Dr. Gregg, I believe the ATA suggested that the air quality problem in other modes of transportation are the same.

Should we equate the ventilation system in the aircraft with that of a bus or a train?

Dr. GREGG. That is a difficult question to answer. From a scientific point of view, strictly on what evidence we have, I think we have to say we have not looked into the quality of air on buses versus airplanes, or at least I am not familiar with it. It is not my area, by the way, of knowing much about the quality of air on a variety of public transportation vehicles.

The fact that one is up at a pressure of 8,000 feet might very likely create differences in susceptibilities to a variety of animate or inanimate agents. I do not know the answer to that.

I really wonder whether there have been studies to direct attention to that point. I think the fact that one has the opportunity to leave a bus or a train perhaps a little bit easier than one could leave an airplane makes to me anyway a great deal of sense in terms of qualifying or classifying these modes of transportation. One is in a rather unique environment up in the air, which allows you perhaps not to do exactly what you would like. But I think there might be more opportunities to get a change of air in other forms of ground transportation.

Senator INOUYE. In other words, the air ventilation system in an aircraft is a life support system, is it not?

Dr. GREGG. Everything I have read and heard would lead me to believe that, yes.

Senator INOUYE. But not in a bus or a train.

Dr. GREGG. Apparently not, no. You can open windows occasionally, and you can ask the bus driver to stop, and you can get off at the next stop.

Senator INOUYE. So there is a world of difference.

Dr. GREGG. Yes; but from a scientific point of view, in terms of, as I say, particulate, animate and inanimate, that I think is an issue that has not really been addressed yet.

Senator INOUYE. Have you conducted any studies of the impact of air ventilation rates, flow rates on the transmission of diseases?

Dr. GREGG. At CDC we have not.

Senator **Inouye**. So you have not compared disease as it relates to pilots and to flight attendants.

Dr. **Gregg**. No; we have not, not in communicable diseases.

Senator **Inouye**. Would there be any difference, would you say?

Dr. **Gregg**. Passengers versus pilots?

Senator **Inouye**. Well, the testimony is that the pilots get oftentimes 20 times as much fresh air as passengers and flight attendants.

Would that make any difference in transmission of diseases?

Dr. **Gregg**. It might. It is a very difficult question to answer, and I would only be conjecturing. It depends upon the threshold levels that one needs to have in the respiratory tract before you acquire a disease, and I have no idea what the threshold levels would be in the cockpit versus the rest of the aircraft.

Senator **Inouye**. In these two hearings, several witnesses have suggested that the Kodiak flu case was the only documented one apparently in the world. Does that mean that there are not any others around?

Dr. **Gregg**. No, it does not mean that, Senator.

Senator **Inouye**. Would dispersal of passengers make a difference?

Dr. **Gregg**. Yes.

Senator **Inouye**. Have we conducted any studies?

Dr. **Gregg**. CDC has not, and I am not aware of anyone who has essentially followed a cohort of passengers through a variety of flights and followed them up on a systematic, scientific basis.

Senator **Inouye**. Why do they not pick some island community such as Hawaii for that? It is pretty controled, is it not?

Dr. **Gregg**. We would be delighted.

Senator **Inouye**. Seriously, why do we not?

Dr. **Gregg**. It can be done, as I indicated in my testimony. Epidemiologic studies like this require a lot of planning and a great deal of effort, and really have to be done many, many times under different circumstances for conclusions of any real usefulness to be drawn. That is my judgment.

It is hard to study people these days and study them under controlled conditions. It is very difficult. And to do the job correctly, I would think we would need assistance of industrial hygienists and a variety of other people to correlate what we found with what was in the air at the time, and this—it is not that it cannot be done, Senator, I am just saying that I visualize it, having been in epidemiology for a number of years, as being a major undertaking.

Senator **Inouye**. Assuming that studies that we conduct confirm that there are problems in cabin environments, can changes be made that are not too expensive? I ask this because the FAA seems to be concerned about cost.

Mr. **Werjefelt**. I will answer that. The changes can be made very simply. We are talking about nickels and dimes, in some cases, per ticketed passenger. In other words, if we are now finding problems with the fresh air ventilation rate of 4 cubic feet per person per minute—there is, incidentally, data which shows that 40 to 60 cubic feet per person per minute provides a nontransmission type of environment for microorganisms. Since it is all fresh air being brought in, the cost for bringing it up to 10 cubic feet, from 4 could not be more than 20 cents per ticketed passenger, at the utmost. This is accomplished by just turning on the equipment, which is already there.

If you want to go beyond the 20 cubic feet of fresh air per person per minute in the passenger cabin, you are then exceeding what is currently installed on most aircraft. So, then you are talking about additional equipment being installed. It is something that can be done very readily—to double the capacity to 40 cubic feet. We have done some development and research work in the area. The present system of ventilating an aircraft is exceedingly costly because you are bringing air from the engine, which means you have to run the engine at a higher thrust, and then you are just dumping it out the ventilation and pressurization doors afterwards—after plenty of recirculation.

We proposed a system where you would take the cabin air and bring it back to the engine again. The losses would be very, very minimal even if you wanted to run 100 cubic feet of fresh air per person per minute through the plane. So there are ways of solving it technically and economically. There is no question about it.

Senator INOUYE. In your testimony you mentioned zero ventilation.

What is that, and do we have any evidence of zero ventilation?

Mr. WERJEFELT. Yes; there is plenty of evidence in that regard. It is common practice for pilots to turn off the ventilation packs under certain circumstances, taxi operations, takeoff. One notable evidence of this—I do not think it is common knowledge, but one notable piece of evidence in this is the Pan Am New Orleans disaster. In the transcript of tape recordings, which I have read through, it was a no-pack operation takeoff. This is common practice, many, many times. It is very easy to measure in the cabin. All you do is measure the carbon dioxide content in the air, and you will see how it just goes right up the scale.

Senator INOUYE. Dr. Gregg or Dr. Stock, with the present aircraft structure, apparently there was no filtration system to keep out virus and bacteria.

Would it be relatively inexpensive to place one in aircraft?

Dr. GREGG. I am going to defer to Dr. Stock because I know nothing about the mechanical aspects of filtering out viruses or bacteria.

Dr. STOCK. Well, we are in real trouble then because I really do not know anything about filter efficiencies for biological materials. My area of expertise is chemical agents. I believe there are some filters already installed that apparently take care of ozone. There are various types of filters that would remove particulates.

I cannot tell you right now what the efficiencies of those filters would be or what the cost effectiveness of installlation would be, but generally, in the case of indoor air quality, rather than try to develop bigger and better filter systems, we find that just by increasing the amount of fresh-air flow through the indoor environment, that this brings down the concentration of any pollutant that is generated indoors, and that seems to be the tactic that we generally recommend.

Senator INOUYE. So then there is a correlation between the rate of flow and transmission of disease?

Dr. STOCK. Well, I cannot address the transmission of disease and biological species. That is not my area of expertise.

Senator INOUYE. Or the presence of disease.

Dr. STOCK. If you are talking about a physiological reaction to a chemical pollutant, then the physiological reaction would certainly be related to the dose received by the person; the dose would depend upon the exposure; the exposure would depend upon the concentration in the air, and that would depend upon the amount of air infiltration to the inside environment.

However, if an airliner is flying through a high ozone concentration outside, then increasing the air intake is going to increase the level of ozone inside the aircraft. So it is not a universal remedy. That is why I referred to just the effect on pollutants generated inside the environment, whether it be in an airplane or in another indoor environment. Then the greater the amount of fresh air brought in from the outside, and the greater the flow rate, the lower the concentration, usually.

Senator INOUYE. The panel of flight attendants spent much time on hypoxia. Is that something that we should be concerned about?

Dr. STOCK. Yes, I think that is something that should be investigated, and I am also concerned with the fact that carbon monoxide levels can sometimes be elevated. I believe there is a report indicating that a concentration of 10 parts per million was measured in a United Air Lines aircraft.

If that concentration lasted 8 hours, that would exceed the national ambient air quality standard for carbon monoxide, and if you are talking about a hypoxic condition caused by a decrease in the environmental concentration of oxygen, then this may be compounded by the presence of carbon monoxide, which can act as chemical asphyxiant by reacting with the blood, and can decrease the amount of oxygen that would be available to tissues and cells. So you may have a combination effect from lack of oxygen in the air as well as the presence of carbon monoxide in the area. This is something that I think should be looked at much more closely.

Senator INOUYE. Does CDC agree with that?

Mr. LEMEN. From the point of view of NIOSH, yes, I would agree with that, that it is something that should be looked at and is of concern.

Senator INOUYE. Do you believe that FAA is being responsive to this problem?

Mr. LEMEN. I would rather not answer that question because I really have no direct knowledge of whether FAA is or is not being responsive to the problem.

Senator INOUYE. As far as your direct knowledge is concerned, there is no activity in the FAA.

Mr. LEMEN. I have no knowledge of activity.

Senator INOUYE. So there is a possibility that nothing is being done.

Mr. LEMEN. That is a possibility.

Senator INOUYE. Thank you very much.

Senator KASSEBAUM. Thank you very much. We greatly appreciate the panel's testimony.

I would also like to say, I certainly very much appreciate Senator Inouye's interest in this, which has been very thoughtful and very persistent. I think he is determined that we are going to address this issue, and I salute him for this because a year has elapsed since we discussed this, and it seems apparent that in that year's time not much has changed, and more and more people are flying. I think it would be enormously helpful to us to obviously have at least more data on which we can make some of these decisions.

Thank you very much.

Senator **Inouye**. I would like to say this for the record. If it were not for the gentlelady from Kansas, these hearings would not have been held, no matter how insistent I may be. So I am grateful not only as a Senator but as a frequent flier, and I am getting a bit concerned as to whether I should be returning to Hawaii as often as I do. But listening to this panel, I feel confident that a study will come about.

I hope that I can fly with some sense of safety, maybe not today, but in the future.

Senator **Kassebaum**. In comfort, too.

Thank you.

[Whereupon, at 11:58 a.m., the subcommittee recessed subject to the call of the Chair.]

ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

STATEMENT OF THE AMERICAN ASSOCIATION FOR RESPIRATORY THERAPY

The American Association for Respiratory Therapy welcomes the opportunity to comment on S. 197, legislation, which if enacted, would require further independent study of specific issues related to safety and comfort of airline passengers. Our Association, which represents more than 25,000 respiratory therapy practitioners across the country, has extensive expertise in some of the areas addressed in the proposed legislation, and we want to share our views with the Committee. In January, 1982, the AART submitted to the Health Subcommittee of the House Energy and Commerce Committee a detailed statement on the negative health effects of sidestream smoke (more commonly known as passive smoke) on nonsmokers.

We believe that it is imperative to continue additional independent study of several matters, particularly the issue of passive smoking on board scheduled airline carriers. There have been, to our knowledge, only minimal, poorly designed studies to examine the effects of passive smoke on non smoking passengers. We are aware of the very limited ventilation requirements for passenger areas compared with cockpit ventilation, and believe that a detailed study which would measure carboxyhemoglobin levels of non smoking passengers adjacent to smoking seats over short and long haul flights would give the Congress and the airline carriers additional important information on which to base future decisions.

We also believe that it is important to conduct the specific studies identified in the proposed legislation. On the one hand, we recognize that certain issues can be overstudied, and that additional studies simply delay important decisionmaking processes. Nevertheless, until there is definitive information regarding passive smoking, the quantity and quality of humidification, and a thorough examination of the need to update and modernize emergency breathing equipment, we believe that the Federal government will be doing a drastic disservice to the flying public. The AART wishes to emphasize that as a professional organization of respiratory therapy practitioners we are aware of the deleterious effects cigarette smoking has on the smoking public as well as the public at large. The AART strongly recommends that the legislative language of S. 197 be amended to include an independent study on the health effects of passive smoke on non smoking passengers.

Our Association fully supports proposed CAB regulations regarding the banning of all types of smoking on short haul flights and passenger planes which accomodate 60 passengers or less. We believe that these proposals would go a long way in not only improving the health of the nonsmoking flying public but perhaps even encourage smokers to reconsider their own activities.

If our Association can be of further assistance to the Committee, please feel free to contact us directly.

STATEMENT OF THE AMERICAN LUNG ASSOCIATION

The American Lung Association, which is this country's oldest voluntary health association, welcomes this opportunity to endorse S. 197 and its call for an independent study of the measures to assure air quality in the cabins of commercial aircraft. This is a matter that has always been of great concern to the public-at-large as well as airline personnel and in recent months has taken on even greater importance.

The protection of human lungs is of primary importance to ALA. Founded as the National Tuberculosis Association in 1904 to fight what was then the country's leading cuase of death, ALA's current goal encompasses the control and prevention of all lung disease. A major program priority for us is the fight for clean air, including the emerging problem of indoor air pollution. The confined structure of an aircraft cabin poses particular problems in this regard.

As has been pointed out by the Civil Aeronautics Board in its current rulemaking procedure on smoking aboard aircraft (14 CFR 252) there is widespread feeling that the air quality in the passenger cabin of domestic aircraft is inadequate. When smoking is permitted that quality quickly becomes unacceptable. The Federal Aviation Administration ruling that passenger compartments be "suitably ventilated" and limiting the amount of carbon monoxide and other fumes that may be present does not provide a standard with the indicated stringency factor. A more precise definition is required which recognizes minimum standards for health and safety in confined spaces. The ALA recommends adoption of a ventilation standard which provides, at a minimum, at least a rate of fresh air per person per minute of 40 to 60 cubic feet. Further, the feasibility of having this standard monitored by the Environmental Protection Agency should be explored.

The air circulation in an airline passenger cabin is far less than passengers and attendants are accustomed to on the ground. While 40 to 60 cubic feet cf fresh air per person per minute is a minimum health and safety standard recognized by many experts, the passenger cabin often has a fresh air supply far below this on average. In House testimony of Bertil Werjefelt, President of the Xenex Corporation which does research and development work in energy conversion systems, this statement was made:

"For health and safety reasons pilots are provided from 75 to 250 cubic feet of fresh air per person per minute. At the same time the fresh air ventilation rate in the passenger cabin of an aircraft may be below 7 cubic feet per person per minute . . . In expert circules it is well recognized that 40 to 60 cubic feet of fresh air per person per minute is an appropriate minimum to provide for a minimum safety health standard in the confined and crowded environment of an airline cabin. A lesser fresh air ventilation rate considerably increases the risk of transmission of contagious diseases. The very low fresh air ventilation rates in the passenger cabin has resulted in a substantial increase in virus, bacteria, fungus and other micro-organisims in the cabin air. This matter has been documented in the Senate Aviation Subcommittee files." [1]

The above references relate to the general air quality situation facing airline passengers and personnel. When the factors of smoking and the needs of especially sensitive persons are taken into consideration, the problem of assuring adequate air quality is exacerbated. The ALA believes that a review of the scientific literature provides a sound basis for smoking restrictions aboard aircraft and, further, that there should be a total ban on smoking aboard commercial aircraft. A ban offers the only option for providing complete protection from the health and safety risks of smoking in the confined space of an aircraft cabin. The ALA has supported the rulemaking by the CAB which would ban smoking on short flights (2 hrs.) and on commuter aircraft (seating capacity of 60 seats) as an initial step in this direction.

Since publication of the White-Froeb study, "Small Airways Dysfunction in Nonsmokers Chronically Exposed to Tobacco Smoke," more evidence has accumulated on the dangers of involuntary smoking. (New England Journal of Medicine, 1980; 302: 720–3). The Surgeon General's Report on Smoking in 1982 details many of these studies on involuntary smoking and draws the conclusion "that the evidence does raise concern about a possible serious public health problem." For example, a study conducted in Japan implicated the smoking habits of husbands in the development of lung cancer in nonsmoking women who are continually exposed to their husband's smoking: 192,261 men and 142,857 women were involved in this study. (Hirayama, T., British Medical Journal, 1981; 282:183–5).

In a recently published five-year study on the effects of parental smoking, the lungs of those children whose mothers smoked showed a 7 percent decline in vital capacity, on average, compared with those children whose mothers did not smoke. This article also summed up the results of other studies on the effects of parental smoking and raises additional concerns about adverse effects in this area. (Tager, I., et al, New England Journal of Medicine, 1983; 309: 699–703).

Studies of involuntary smoking are based on environments without unusual constraints on air circulation. As mentioned, the situation in aircraft cabins is far different. The relatively low humidity (approximately 20%) of the aircraft cabin also contributes to the smoking-related irritation experienced by the nonsmoker. A dry atmosphere exacerbates the irritation of the mucous membrane lining to the sinuses and upper respiratory system. This effect is particularly pronounced for persons with allergy, asthma, respiratory infection and chronic pulmonary disease. (Johnson and Ronge, Building Services Engineering, 1976; 48: 254–262; Surgeon General's Report on Smoking and Health, 1979, 11: 26–27). Therefore, the aircraft represents a unique environment for measuring the health effects of the intermittent exposure to sidestream tobacco smoke.

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[1] Before the House Subcommittee on Investigations and Oversight, Committee on Public Works and Transportation, July 1983.

In a recent study, ozone toxicity-type symptoms (e.g., shortness of breath, chest tightness, wheezing) were reported by flight attendants flying regularly at high altitudes. (Reed, D., et al, American Journal of Industrial Medicine, 1981; 1: 42–54). Significantly, these symptoms were associated directly with flight duration, altitude and type of aircraft, but not with the number of years worked, sex, medical history or home residence. This exposure to ozone, another irritant to the respiratory mucous membrane, may also create in some individuals an enhanced sensitivity to tobacco smoke irritants in the high altitude aircraft environment.

Dr. Claude Lenfant, Director of the National Heart, Lung and Blood Institute of the National Institutes of Health, in testimony May 6, 1983 before the U.S. Senate Committee on Labor and Human Resources, stated that recent evidence indicates that "so-called sidestream smoke from somebody else's cigarettes is not just a nuisance for the nonsmoker who is exposed to it, but can produce adverse effects on the nonsmoker's heart and lungs."

The problems cited by Dr. Lenfant are particularly acute for that considerable segment of the population with special health problems. That susceptible population is substantial, with estimates that 20 percent of the population suffer from a chronic pulmonary or cardiac condition. There are an estimated 2 million Americans who are sensitive to tobacco smoke and suffer smoke-caused asthma episodes. Certainly those persons and others who are allergic to smoke should be protected from the health risks of exposure to tobacco smoke when traveling. Any questions of doubt should be settled in favor of protecting such individuals.

The ALA thanks this Subcommittee for holding these hearings and commends Senator Inouye for proposing such an objective consideration of the unique factors governing the aviation environment.

Wright State University,
Dayton, Ohio, October 31, 1983.

Senator Daniel K. Inouye,
U.S. Senate,
Washington, D.C.

Dear Senator Inouye: This letter is written in support of your activities concerning upgrading airline passenger cabin environments.

It is now time for a study of current airline cabin environments, conducted by a group external to the regulatory authorities. Key areas for concentration are humidity, temperature variations, air flow changes, cigarette smoke, plastic "outgasing", solvent vapors and airborne particulates.

The Federal Aviation Administration requires in FAR 25 that each cockpit crew member be supplied with a minimum of 10 cubic feet of air per minute under 25.831(a). The same requirement for passenger cabins is not spelled out so passengers often get less than this amount of exchange. The section provides that the air must be free from harmful or hazardous concentrations of gases or vapors but aside from carbon monoxide, carbon dioxide and ozone, upper levels of gases and vapors are not specified. Unfortunately, there are no humidity, cigarette smoke, airborne particulate or other substance standards.

Many passengers are annoyed by the dry air and cigarette smoke that develops in current airline aircraft during cruising flight. Some according to the Surgeon General of the U.S. Public Health Service, will have adverse health effects. This is aggravated by the developing suspended particulate matter and any gases coming from plastics or vapors from cleaning solvents. For some persons, the above factors can constitute a distinct health hazard.

I strongly support your proposal to study the above problem. Modern technologic progress can be applied to diminish the adverse effects on occupants of the above factors.

Sincerely yours,

Stanley R. Mohler, M.D.,
Professor and Vice Chairman, Department of Community Medicine,
Director, Aerospace Medicine.

Action on Smoking and Health,
Washington, D.C., November 22, 1983.

Hon. Daniel K. Inouye,
Senate Subcommittee on Aviation,
Senate Hart Office Building, Washington, D.C.

Dear Senator Inouye: We understand that at your hearing on airline cabin safety and health (Senate Bill 197, November 9, 1983) several members of the Committee asked question about the effects ot ambient tobacco smoke on the majority of passengers who are nonsmokers. As the organization primarily responsible for obtaining, increasing, and enforcing protection for nonsmoking airline passengers, Action on Smoking and Health (ASH) would like to submit the enclose testimony which covers these very issues.

Briefly, we summarize the medical evidence which indicates that ambient tobacco smoke can have three major kinds of effects on nonsmokers:

1. For an estimated 30 to 40 million Americans with a variety of conditions such as asthma, hay fever, sinus condition, allergies, etc. ambient tobacco smoke can create serious medical problems which have caused nonsmoking passengers to faint, require medication, hospitalization, etc.
2. For healthy nonsmokers without any particular susceptibilities, it can cause irritation with visible symptoms such as red and teary eyes, cough or sore throat, dripping nose, headache, etc.; not only in passengers, but, according to many recent reports, to cabin crew members as well.
3. A number of recent well-documented medical studies indicate that although the full extent of the dangers and effects of tobacco smoke on nonsmokers may not yet have been conclusively proved, substantial research has established that ambient tobacco smoke can cause permanent lung damage to nonsmokers, including possibly lung cancer.

Our testimony also demomstrates how tobacco smoke drifts from the smoking section to the nonsmoking section, and that accordingly most of the toxic products of smoking are also recirculated through the aircraft.

Enclosed please find a copy of ASH's testimony which we request be printed in the record of the hearings on this bill. We are also attaching a copy of our entire Comments to the Civil Aeronautics Board (CAB)[1] upon which our testimony is based, and which also sets forth our proposals to that agency for dealing with these problems. We hope that you might be willing to express your support for some or all of these proposals to the Civil Aeronautics Board (CAB) in their current rulemaking proceeding.

Very truly yours,

John F. Banzhaf III,
Executive Director and Chief Counsel.

Enclosure.

Statement of Action on Smoking and Health

Action on Smoking and Health (ASH), a tax-exempt, scientific, and educational organization concerned with the problems of smoking and the rights of nonsmokers, respectfully submits the following testimony concerning the effect of ambient tobacco smoke on nonsmoking airline passengers.

This testimony is based upon and taken from the comments of ASH filed with the Civil Aeronautics Board on November 7, 1983. As the organization primarily responsible for the establishment, extension, and enforcement of protections for nonsmoking airline passengers, ASH has a significant expertise and experience in the area which it is happy to share with this Subcommittee.

IB. SUMMARY OF MEDICAL EVIDENCE CONCERNING AMBIENT TOBACCO SMOKE

In previous smoking proceedings before the Board, ASH and other scientific organizations have cited the growing body of medical and scientific literature relating to the effects of ambient tobacco smoke on nonsmokers. Several of these medical references were noted with interest by the U.S. Court of Appeals in its opinions in *Ash* v. *Cab,* 699 F.2d 1209 (D.C. Cir. 1983). For the convenience and information of the Board, some of the major documents in this area are listed in an appendix, and a few of the recent and more important ones are summarized. However, because of the complexity of the issue, this section attempts to summarize very briefly what the evidence indicates.

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[1] Retained in committee files.

Most passengers are "involuntary" smokers

First, the term "nonsmokers" is a misnomer, since very few Americans are truly nonsmokers. Approximately 35 percent of the adult American population are voluntary smokers, and this proportion seems to be lower—about 30 percent—among airplane passengers. This is consistent with studies which show that the proportion of smokers generally decreases with increasing education, social position, and income—and the common knowledge that a large proportion of airplane passengers are business flyers, and that the remainder can at least afford this means of travel.

The majority of Americans and the majority of airline passengers have been termed "involuntary smokers" by the Department of Health and Human Services—and "forced smokers" by other researchers—to emphasize that even so-called nonsmokers nevertheless are forced to inhale significant amounts of the toxins produced by cigarette smoking. There are several reasons why this is true, despite the inescapable fact that the smoke from an idling cigarette is diluted many times as it enters the air.

Why involuntary smokers inhale so many cigarettes

First, the smoke from an idling cigarette contains a far higher concentration of a wide variety of toxins than the smoke produced if a cigarette is puffed on. Just like a fire in a home fireplace, a burning cigarette needs substantial amounts of oxygen to burn cleanly. A fire—in a cigarette or fireplace—which receives little air tends to burn at a lower temperature and "dirtier," producing substantially higher levels of various toxins than a fire receiving a substantial amount of oxygen. When a smoker actively puffs (inhales) a cigarette, he draws in a larger amount of oxygen—like fanning a fireplace fire—and, as a result, the tobacco burns more cleanly and the proportion of various toxins in the smoke is lower.

Second, the smoke which the smoker inhales by smoking his cigarette is drawn through at least one, and in some cases two or more, filters. Even when smoking an unfiltered cigarette, the smoker draws the smoke through the tobacco in the unburned portion of the cigarette. This tobacco is a moderately effective filter which has the effect of filtering out some of the toxins; this filtration, of course, does not occur with regard to the smoke which drifts directly into the air from the burning tip of the cigarette. Moreover, a large and growing percentage of cigarettes today contain filters at their tip which provide additional and very effective filtration for the smoke which is passing through them. Without such filters, it is generally conceded that the tobacco industry could not produce cigarettes with the lower tar and nicotine rating desired by most smokers. Once again, smoke going directly into the air does not pass through any such filter, and therefore contains far more toxins than the smoke being inhaled directly by the smoker.

The third factor is that a smoker actively "smokes" his cigarette—in the sense of holding it to his lips and drawings in the smoke—only a very small portion of the total time that the cigarette is lit. Thus, while the cigarette may be discharging its highly toxic combustion products into an airspace for ten, fifteen, or even twenty minutes, the smoker is actively drawing on it only probably no more than thirty to forty-five seconds. For all of these reasons—the "dirty" burning of idling cigarettes, the lack of the filtration protecting the smoker, and the small amount of time spent actively puffing—it is not at all surprising that several studies have shown that involuntary smokers are forced to smoke the equivalent of many cigarettes a day in smoking situations encountered frequently in daily life. The effect of this involuntary smoking can be broken up into several different categories.

Healthy nonsmokers suffer physical irritation

First, studies[1] show that the majority of healthy nonsmokers do suffer from a variety of physical irritations when exposed to tobacco smoke. The most common of these effects relate to the eyes (which become red, tear, or are otherwise sore), the nose (sneezing, tickling, discharge, nasal irritation), and the throat (coughing, hoarseness, general irritation). In addition, many healthy nonsmokers report experiencing a headache, probably from exposure to the carbon monoxide which builds up from the burning of cigarettes, and nausea.

Although all of these problems appear to be short-term ones, they can nevertheless be serious. Indeed, if people experienced these irritations in the absence of cigarette smoke, they would probably conclude that they had a cold or flu, and would seek medication and/or bed rest in an attempt to obtain relief. One of the major reasons for the purchase ot eyedrops, and a substantial factor in the purchase of other cold-type medications, is the real and serious physical irritations people suffer from exposure to tobacco smoke. It should also be noted that these irritations can be even more serious when otherwise healthy nonsmokers suffer from a wide variety of temporary conditions such as an ordinary cold of flu, motion sickness, lack of sleep, jet lag, stress of temporary overwork, exhaustion, or pregnancy, etc.

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[1] Barad, Smoking on the job: the controversy heats up, 48 Occupational Health and Safety 21–24, 1979; Repace, The Problem of Passive Smoking, The Symposium on Health Aspects of Indoor Air Pollution, The New Academy of Medicine, May 28–29, 1981.

Sensitive nonsmokers suffer more serious problems

Second, the evidence is now very clear that a substantial proportion of the adult population as well as many children suffer from a wide variety of medical conditions which can make them expecially sensitive to the effects of tobacco smoke. The most common conditions include, for example, asthma, hay fever, allergies, sinusitis, bronchitis, emphysema, and a variety of other respiratory, heart, and circulatory conditions. For many of these people exposure to tobacco smoke, even in concentrations ordinarily found in the nonsmoking sections of airplanes, produces serious health problems. In the most serious situations it can even be life-threatening, as in the case of a person with a serious heart and asthmatic condition where smoke can interefere with breathing and cause a coughing fit preciptating a heart attack.[2] The letters received by the Board from many of these individuals, their complaints filed under oath with this Board, and the testimony before the Board of physicians such as Dr. Tate [3] who treat such persons, is ample evidence of the very serious health problems and risks they are forced to endure simply so that others may obtain the satisfaction of their habit.

Ambient smoke can cause long-term consequences

The third category of problems posed by ambient tobacco smoke are those related to long-term consequences. One famous study [4] has shown that exposure to tobacco smoke in the office causes permanent lung damage in nonsmoking workers. Two studies in Japan [5] and Greece [6] have shown that nonsmoking wives of husbands who smoke have a substantially higher incidence of lung cancer than of comparable wives whose husbands do not smoke. These studies are considered particularly significant because in both countries wives tend to remain in the home, and therefore are not subject to the variety of exposures to cigarette smoke and other toxins which wives in America would frequently be exposed to. The Japanese study was recently followed up, and the results tended to further substantiate the earlier conclusions. Since the wives would breathe the smoke of their husbands largely through their noses, a follow-up study [7] was made to see if they also had a substantially increased risk of cancer in the nasal cavities. The answer was "yes."

There are also studies which show that ambient tobacco smoke can have serious longer-term effects, at least on children who tend to be more susceptible.[8] Thus, it has long been known that children in homes where smoking occurs have a higher incidence of respiratory problems, including those which require medical treatment and hospitalization.[9]

All of the above is not to say that science can today establish long-term harm to nonsmokers with the same medical certainty that it has been established with respect to smokers. Such proof took literally hundreds of studies over many years. However, the evidence certainly seems to point in that direction, and it is beyond doubt that tobacco smoke contains dozens of carcinogens, co-carcinogens, poisons, and other toxins for which a safe lower limit has never been found. It is respectfully suggested that in such a situation smokers and the airlines should not be allowed to play Russian roulette with the lungs and health of nonsmoking passengers. Just as many of our outdoor air pollution limitations were based upon strong, but less-than-conclusive evidence, and just as exposure to many other suspected health hazards is routinely limited on evidence of less than substantial medical certainty, so, too, ASH would suggest that the involuntary exposure of nonsmoking passengers to smoke can and should be limited.

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[2] Tate, The Effects of Tobacco Smoke on the Non-Smoking Cardio Pulmonary Public, Prodeedings/Third World Conference Smoking and Health, Volume II 329-335 (1975).

[3] Statement of Charles F. Tate, Jr. M.D. at Oral Argument before the Civil Aeronautics Board (Docket Number 20944) on May 13, 1981. Transcript 50-59.

[4] White and Froeb, Small-Airways Dysfunction in Nonsmokers Chronically Exposed to Tobacco Smoke, 302 The New England Journal of Medicine 720-723 (1980).

[5] Hirayama, Non-smoking wives of heavy smokers have a higher risk of lung cancer: a study from Japan, 282 British Medical Journal 183-185 (1981).

[6] Trichopoulos et al., Lung Cancer and Passive Smoking, 27 International Journal of Cancer 1-4 (1981).

[7] Hirayama, Passive Smoking and Lung Cancer, Presented at the Fifth World Conference on Smoking and Health, Winnipeg, Canada, July 10-15, 1983.

[8] American Academy of Pediatrics, 33 News and Comment, April 1982, 2-3.

[9] Colley et. al., Influence of passive smoking and parental phlegm on pneumonia and bronchitis in early childhood, Lancet 2 (7888): 1031-4, 2 November 1974; Harlap et al., Infant Admissions to hospital and Maternal smoking, Lancet 1: 529-32, 30 March 1974; American Academy of Pediatrics, Committee or Environmental Hazards, Effects of cigarette-smoking on the fetus and the child, Pediatrics 57 (3): 411-3, March 1976.

Summary of health effects on nonsmokers

In summary then, ambient tobacco smoke poses health problems for virtually all nonsmokers in varying degrees, depending on the length of the exposure, the number of smokers, the size of the enclosure, and the amount and type of ventilation and filtration. For those with no other health problems, the exposure can produce a variety of real physical irritations, and exacerbate other temporary conditions. For those millions with many other preexisting medical conditions, tobacco smoke can pose a clear and present health hazard, including even the risk of death.[10] Although ASH knows of no such deaths yet, there has been testimony and complaints of nonsmokers who were forced to be hospitalized as a result of exposure to tobacco smoke on airplanes.[11]

In addition, a growing body of evidence clearly indicates, even if it cannot yet conclusively prove, that ambient tobacco smoke can cause very serious long-term problems, including even lung cancer.[12] Faced with the evidence, it is respectfully suggested that the exposure of nonsmoking passengers to the known toxins in tobacco smoke be held to an absolute minimum, and that doubts be resolved on the side of good health and against the pleasure a small minority wishes to enjoy at the expense of the majority.

IC. PROBLEMS OF TOBACCO SMOKE ABOARD AIRCRAFT

The problems of smoking aboard aircraft arise primarily from two major factors. The first is that despite the airplane's ventilation system, smoke tends to drift from the smoking section into the nonsmoking section. The second is that because of the ventilation system, smoke and most of its toxins are efficiently recirculated from the smoking section into the nonsmoking section. Each of these factors will be discussed briefly.

Problems caused by drifting tobacco smoke

Short of having a gentle zephyr blowing in a uniform direction from the nonsmoking section and into the smoking section at all times, there is no way any ventilation system can prevent smoke from drifting. With anything less than a steady breeze, smoke from cigarettes will tend to rise from the cigarette and then gradually disperse itself. Indeed, some studies[13] show that smoke particles tend to be attracted to objects with an opposite electrical charge, so that the frequent nonsmokers' complaint that smoke tends to drift towards them is based on more than paranoia or imagination.

It is common knowledge to all passengers who have been forced to sit in the last row or two of the nonsmoking section that a substantial portion of the smoke generated by the passengers behind them drifts forward. This is one of the reasons why so many passengers request seats either in the front or in the middle of the nonsmoking section. This drifting occurs in many cases even if the nonsmoking passenger's air jet is operating—something which is not always possible, because it may cause added discomfort and/or a draft for the nonsmoker. This problem is also well documented in the complaints which have been filed by passengers, and by the many letters submitted in this and earlier proceedings before the Board. A small sample from such letters and complaints are set out in an appendix.

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[10] Tate, The Effects of Tobacco Smoke on the Non-Smoking Cardio Pulmonary Public, Proceedings/Third World Conference Smoking and Health, Volume II 333 (1975).

[11] Statement of Charles F. Tate, Jr. M.D. at Oral Argument before the Civil Aeronautics Board (Docket Number 29044) on May 13, 1981. Transcript 50.

[12] U.S. Surgeon General, Report, The Health Consequences of Smoking: Cancer (1982) 237-249.

[13] Kingdon, Possible Biological Effects of Electrically Charged Particles in Tobacco Smoke, 189 Nature, 180-183 (1961); Krueger, An Introduction to Experimental Aerobiology, Chapter I, Atmospheric Ions and Aerosols (Dimmick and Akers, 1969).

Problems caused by recirculating the smoke

The other major problem is that most of the tobacco smoke generated aboard an airplane is simply recirculated. The airlines have not denied that very little fresh air is taken in, particularly above 30,000 feet where it is very cold and not dense, and correspondingly little stale air is expelled. Thus, claims that so many air changes are made per hour must be taken with several grains of salt (or smoke), since the air being exchanged—unlike ventilation systems on the ground—is already polluted. Moreover, as recent Congressional testimony indicated,[14] passengers receive only 4-7 cubic feet per minute of recirculated air, compared with 40-60 generally required for good health, and 75-250 provided to the pilots.

Obviously, some filtration occurs, but there seems to be general agreement among experts that such filtration is of limited benefit. First, there is no filter which can filter out those components of tobacco smoke which are gases rather than solids. Thus, gases in tobacco smoke, such a carbon monoxide, hydrogen cyanide, etc., are simply recirculated. Moveover, only a portion of the solid portions of the smoke are capable of being filtered out when more are constantly being generated. A dramatic example of this factor is the statement by an airline captain that he clearly smelled smoke within minutes of turning out the "no-smoking" sign even though smoking was not occurring in his cockpit, and although pilots receive far more air exchanges than passengers.

The matter of poor air quality is extremely serious as it results in elevated levels of carbon dioxide in the passenger cabin. This can cause cardiac arrhythmias to millions of persons with marginal cardio-respiratory conditions. In this connection, the testimony before the Congressional Subcommittee, which was mentioned earlier in this section IC, referred to a study by Dr. Danelo Canete, former Senior FAA Medical Examier in Honolulu, which shows that six to seven out of every hundred air travellers with ischemic heart disease die three to four days after air travel.[15]

Another dramatic example of the extremely pervasive character of tobacco smoke was provided by a recent experiment.[16]

The experiment was performed at a weekly bingo game in a Wisconsin Knights of Columbus hall, 68 by 46 by 10 feet in size. It was centrally air-conditioned and had six ceiling-mounted electrostatic fan-operated air cleaners. Twenty percent of the available seating was reserved for nonsmokers, and it was estimated that not more than 20 people smoked at any one time. Test subjects seated themselves in the middle of the no-smoking area and were at least 15 feet from the nearest smoker. Other test subjects seated themselves in the middle of the smoking section.

Measurements showed that the levels of carbon monoxide in the smoking and no-smoking sections were virtually identical and that the levels of carbon monoxide in the blood of both groups of test subjects rose substantially even during the first hour and continued to rise during the second and third hours. Given a standard coordination test, both groups performed more poorly than they had done when tested in a larger smoke-free area. All of the subjects in both groups also reported teary eyes, itchy noses, headaches, coughing, and nasal congestion.

The scientist making the study concluded that "the study demonstrated that one volatilized constituent of tobacco smoke, CO, was experienced and reacted to in an identical fashion, by people seated in adjacent smoking/nonsmoking environments. Thus inferring that other substances may have diffused throughout the nonsmokers' environment to the same extent."

In summary, because of the twin problems of the drifting and recirculation of tobacco smoke, many passengers seated in the no-smoking section nevertheless continue to suffer from serious physical irritation and from the health hazards caused by passengers who desire to reward themselves with a smoke. The logical remedies for these problems, short of major restructuring of the airplanes themselves, is to limit the amount of smoke generated in the first place, and to take all reasonable steps to prevent the drifting of the smoke. ASH's recommendations serve to effectuate these twin goals.

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[14] Statement of Bertil Werjefelt, President of the Xenex Corporation to the Subcommittee on Investigations and Oversight, Committee on Public Works and Transportation, U.S. House of Representatives, Re: Passenger Safety and Survivability in Aircraft Cabins, July 12-14, 1983, page 2.

[15] Ibid., page 3.

[16] Olshamsky, 72 American Journal of Public Health, No. 7, p. 737.

ID. OTHER CONSIDERATIONS—FIRES AND CREW HEALTH—AND THEIR RELEVANCE

There are two other major considerations which ASH respectfully submits the CAB should take into account in its deliberations. One, discussed first, is the serious problem of in-flight fires caused by smoking, of which the Air Canada tragedy appears to be a major example. The second is the serious effects cigarette smoking appears to be having on the health of the cabin crew—crew members who not only serve the passengers, but who are their first and probably only line of defense in the event of a variety of emergencies. After briefly discussing each issue, the relevance of these two matters to the CAB will be considered.

Cigarette fires are a major hazard

The Air Canada disaster is only the latest in a series of examples of the dangers of in-flight fires, particularly those caused by cigarettes. Other examples were described by Congressman Mario Biaggi in his recent testimony [17] presented to a Congressional Subcommittee. In the words of Congressman Biaggi:

"It should also be noted that the Air Canada disaster is not an isolated incident. In fact, only nine days later, on June 11, another in-flight lavatory fire occurred aboard a second Air Canada plane headed to Bermuda. That fire was determined to be an act of arson by a disgruntled passenger. On June 25, a third fire broke out in the lavatory waste bin of an Eastern Airlines plane while it was on the runway at Tampa (FL) Airport. Fortunately, there were no injuries in either incident.

"Although it is rare for three aircraft lavatory fires to occur during the same month, there have been a significant number of such incidents over the years. The most tragic in-flight lavatory fire took place on July 11, 1973, aboard a Brazilian Varig Boeing 707-300. Like the first Air Canada fire, the plane made a successful emergency landing (in Paris, France), but 124 people died, 78 percent of them due to carbon monoxide poisoning. The aircraft was totally destroyed.

"Other in-flight lavatory fires aboard U.S. aircraft since 1979 took place on an American Airlines Boeing jetliner on May 4, 1979, near San Juan, Puerto Rico; on a United Airlines Boeing jetliner on August 17, 1981, near Honolulu, Hawaii; on a TWA Lockheed jetliner on August 30, 1982, near Prescott, Arizona; and on a Texas International MacDonald Douglas jetliner on September 7, 1982, near Houston, Texas.

"While the loss of life and serious injuries are the real tragedies, it is also important to consider the tremendous costs involved each time one of these fires spreads out of control. For example, the fatal Air Canada accident totally destroyed a plane worth approximately $5.4 million. The other costs resulting from that accident, including the settlement of lawsuits, will add considerably to that amount."

ASH has received dozens of letters from pilots and flight attendants detailing instances of the fire hazards of smoking on aircraft. Many of these have also been filed by the authors in this docket.

The instances reported involve cigarettes deposited in the trash bins in the lavatories, cigarette burns on the container top of the escape slide in the forward entry area, cigarette burns on upholstery and carpeting, cigarette burns on the buffer container, passengers falling asleep burning a hole in a pillow, etc. See copies of crew reports attached in an appendix.

The Aviation Safety Institute has tabulated from FAA files 45 instances of fires aboard aircraft operated by most of the major air carriers since 1973 through 1981, many of which were caused by cigarettes. Moreover, a stewardess forced to testify anonymously on the nationally televised Nightline program said, in response to a question from Ted Kopple, that the great majority of fires started by cigarettes are not reported.

On October 10, 1983 R. N. Fleischman, a flight attendant at Alaska Airlines, filed a letter in this docket with a copy to ASH which states, in part, as follows:

"(1) Safety—I feel that smoking is probably the number one danger for fire on the aircraft. In my experience, people often decide to get up to wander around the plane, visiting friends, to use the restrooms, or just to stretch their legs. They invariably have a lit cigaette [sic] in their hands. No matter how many times you tell them to sit down, or put out their cigaettes [sic], you always find people roaming the aircraft with burning cigarettes—they just don't listen. I have personally seen people walk out of the restroom with a lit cigarette, throw cigarettes into the garbage in the galleys, fall asleep with cigarettes hanging from their mouths or ash-trays, ect. [sic] I even saw one person drop a lit cigarette after takeoff, which rolled out of sight and was not easy to find."

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[17] Testimony on In-Flight Fires aboard Aircraft presented before the House Public Works and Transportation Subcommittee on Investigations and Oversight by U.S. Representative Mario Biaggi of New York, pp. 1 and 2.

Thus, there can be little question but that smoking on aircraft represents a fire hazard of major proportions. Logic and a reasonable consideration for the safety of both nonsmokers and smokers should dictate that smoking should be held to a minimum, and permitted only where and to the extent reasonably necessary. Several of ASH's proposals seek to effectuate these goals.

Smoke adversely affects cabin crew health and safety

Another factor which should be considered by the Board is the growing number of complaints about the ill effects of tobacco smoke, not from the passengers, but from members of the cabin crew. ASH respectfully suggests that they should be carefully considered for at least two purposes. The first is to suggest that if cabin personnel—who are normally young and healthy and without serious medical conditions—are feeling and going so far as to report ill effects from exposure to tobacco smoke, one can only imagine what effect that same smoke is having on many of the passengers. Many passengers, of course, are older and less healthy generally, and may have any one of a wide variety of medical or health conditions which make the effects more intense and more serious. This the CAB should carefully consider.

The other reason for considering the effects of tobacco smoke on the cabin crew is that the passengers have literally entrusted them with their lives in the event of any number of emergencies. Crew members who are alert and capable of 100% effort are absolutely essential in the event of any emergency situation: emergency landing, ditching, sudden turbulence, or failling of the aircraft, on-board fires from any source, loss of cabin pressure, etc. In addition, their quick and carefully coordinated action can save a life in the event of a heart attack, breathing difficulty, blockage of the throat from swallowing of a foreign object or food, or a variety of other personal emergencies.

But if crew members are sufferig from a headache as a result of inhaling carbon monoxide, or if their eyes are red and sore and perhaps tearing, or if they are hoarse, or just generally feel weak, their performance—including their reflexes and their judgment—in the event of an emergency can be seriously impaired. In this regard, exposure to tobacco smoke can be a major factor, or simply a contributing factor, which, when coupled with stress, overwork, lack of sleep, etc., can rob personnel of the edge which could mean the difference between life and death. Once again, logic would dictate that smoking should be limited to the extent reasonably possible to protect not only the health of the passengers, but also the health of the crew upon whom their lives depend.

Fires and crew health should be considered by CAB

Although safety is the primary goal of the FAA and not of the CAB, it could hardly be doubted that each agency in carrying out its primary mission must give reasonable consideration to the general public interest, including the legitimate goals of other relevant agencies. Thus, for example, in considering proposals to increase airline safety, the FAA can and does give some consideration to the economic impact on the industry, and may decline to adopt measures which would increase safety but only by imposing inordinate and perhaps unfair economic burdens on portions of the industry. In the same way, this Agency would certainly be reluctant to impose requirements within its area of jurisdiction which might create a safety problem: e.g., curtains hanging down into the aisle to prevent the drift of smoking.

But in this situation the proposals the CAB is considering adopting tend to promote these other goals as well, so there is no conflict. Instead, it is respectifully suggested that the additional advantages of reducing fire risks and health problems affecting crew safety performance which would flow from restrictions on smoking give added weight and provide additional impetus and justification for such restrictions, and at the very least compel the CAB to resolve close questions in the direction that favors safety, rather than that which opposes it.

IE. THE PROPER BALANCE BETWEEN REGULATION AND DEREGULATION

In 1981 two members then on the Board voted to totally eliminate all CAB regulations related to the problem of smoking on airplanes. In support of their position they argued that Congress, in amending the CAB Act, had manifested such an intention; that their philosophy of deregulation mandated such a view; and that the airlines, having now realized the growing demands for protection for nonsmokers, could be counted on to deal adequately with them because of pressure from the marketplace. ASH respectfully disagrees with each of these positions, and would like to briefly indicate why it believes continued and even increased regulation of smoking is reasonable and necessary even under a philosophy opposed to unnecessary economic regulation.

With regard to the argument that Congress intended the CAB to alter its regulation of smoking, and that this intention was expressed in the recent legislative amendment, the simple answer is that Congress was certainly on notice of the issue, yet chose to do and say nothing. As the U.S. Court of Appeals noted:[18]

> Finally, the Airline Deregulation Act of 1978, Pub. L. No. 95-504, did not diminish the Board's authority to regulate smoking. To the contrary, although that Act deleted most of section 404, it specifically retained the portion relied upon by the Board to regulate smoking. Legislative history indicates that the desired reform was not aimed at regulation of quality of service, but at the certification procedure that had retarded entry into the industry, expansion of service, and competition over fares. *There is absolutely no indication of congressional intent to remove the Board's authority to regulate smoking.* Thus, although the Deregulation Act reflected a congressional desire to rely more heavily on competition, it did not disturb Board authority to regulate quality of service. [Emphasis supplied]

Health and economic regulations must be treated differently

With regard to the philosophy of deregulation which has been embraced by this Administration and by many Members of Congress, ASH respectfully wishes to point out that it is primarily directed against economic regulations which many feel artificially and unnecessarily maintain barriers to entry, create higher fares, inhibit the provision of new services, and in general place an economic straitjacket on various industries. Yet, ASH suggests, one must reasonably distinguish betwen economic regulations which are designed to and do have these effects, and regulations affecting basic health and safety considerations which fill an entirely different need and which have very little effect on competition.

Surely no one would suggest that the philosophy of deregulation should permit airlines to compete in the marketplace with regard to their maintenance procedures, or the fire and safety equipment carried aboard their planes. While restaurants obviously compete in a large and varied marketplace, no one would argue that they or airlines should be free to skimp on sanitation in food preparation and let the customer choose on that basis. Builders, swimming pools, and many other businesses are free to compete, but basic issues relating to the safety and health of the public are carefully regulated because these are areas where regulation has traditionally been necessary, effective, and not anticompetitive. Likewise, we have long accepted the idea that pollution can and should be regulated where it may effect the public health, and cigarette smoking on airplanes is, of course, the major source of air pollution.

Sensitive nonsmokers need special protection like handicapped persons

Another reason why the Board should not attempt to rely upon market forces to protect those with special sensitivities to tobacco smoke is that they may well be a minority which is too small to achieve its own protection through the operation of the marketplace. Certainly we have seen that most business did not react to market forces to meet the needs of those in wheelchairs, the blind, and persons with other handicaps. It was cheaper to fail to make a reasonable accommodation to those who were unfortunate, and pass up their business, than to make a reasonable accommodation in terms of ramps, Braille markers in elevators, etc. These businesses finally reacted, not out of compassion, and not in response to market demand but, rather, to federal regulations requiring them to do so.

In a very similar fashion, one can think of those with a special sensitivity to tobacco smoke as being handicapped. One federal court [19] and at least two federal agencies [20] have already held them to be so, relying on federal regulation [21] which

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[18] *Action on Smoking and Health* v. *Civil Aeronautics Board* 699 F. 2d 1209, 1214, 1215 (D.C. Cir. 1983).

[19] The U.S. District Court for the Western District of the State of Washington in *Lanny L. Vickers* v. *The Veterans Administration et al.* 549 F. Supp. 85.

[20] The U.S. Merit System Protection Board in *Leroy J. Pletten* v. *Department of the Army* U.S. Merit Systems Protection Board Docket Nos. CHO 7528010099, CHO 75209201 (June 18, 1981) and the Equal Employment Opportunity Commission in *Leroy Pletten* v. *Department of the Army*, Docket Nos. 0180027 et al. (Decision dated February 23, 1982) and Petition No. 03810087, (Decision dated April 8, 1983).

[21] 29 CFR § 1613.702(a) which states that a "handicapped person" is one who:

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defines handicap in terms of physical impairments which affect major functions such as breathing.[22] It is therefore also not hard to see that a failure to reasonably regulate smoking as required to protect those with special sensitivities creates as much of a barrier to entry as the failure to require reasonable accommodation to the needs of persons of limited mobility, the blind, etc. Whether or not the Agency formally makes the determination that passengers with special medical sensitivities are handicapped persons within the meaning of the relevant acts, it may nevertheless apply the general, and by now well-accepted, principle that such persons are entitled to a reasonable protection and to a reasonable accommodation to their condition from the unnecessary actions of others which cause them to suffer from these problems. No less is required by the extraordinarily high duty airlines as common carriers owe to protect the safety and health of all their passengers, including those who are less healthy than others. This duty does not depend on a majority vote or the amount of income their business would produce. To say that persons with serious medical sensitivities are to be left to the mercy of market forces, which they cannot realistically influence, for protection of their health while flying is to deny them any effective protections—and to permit smokers who may exist in greater numbers to subject them to chemical warfare for their own amusement and gratification—stands both law and reason on its head.

AIR LINE PILOTS ASSOCIATION,
Washington, D.C., January 27, 1984.

Hon. DANIEL K. INOUYE,
U.S. Senate,
Washington, D.C.

DEAR SENATOR INOUYE: The Air Line Pilots Association, which represents the safety interests of 34,000 professional air carrier pilots and their passengers, appreciates the opportunity to offer these comments for the record on S. 197, introduced by you on January 26, 1983. The bill would require the Secretary of Transportation to conduct an independent study on the adequacy of Federal Aviation Administration (FAA) rules and regulations pertaining to cabin air quality.

This legislation outlines six separate areas which need to be studied, including amount of fresh air in the cabin, air conditioning limits, humidification, emergency breathing equipment, fire extinguishment, and safe pressurization. All of these items directly influence passenger safety and comfort. However, based on our experience and independent analyses of airline accidents and incidents, the last three can have the most impact on the safety of any given flight. This Association has long been on record in urging the Federal Aviation Administration to improve regulatory requirements concerning these three items. Recent accident experience dramatically highlights the inadequacies of the present FAA regulations. There is no question that improvements are needed.

The Air Line Pilots Association strongly supports S. 197, and hope it will prove to be the catalyst which moves these issues forward. Your staff may wish to contact our Engineering & Air Safety Staff to discuss more specific details on the three provisions of your Bill which we feel provide the greatest potential return for the dollars invested.

Sincerely,

HENRY A. DUFFY, *President.*

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1. Has a *physical* or mental impairment which substantially limits one or more of such person's major life activities;
2. Has a record of such an impairment; or
3. is regarded as having such an impairment.

[22] The term "physical . . . impairment" is defiend, in relevant part, in 29 CFR § 1613.702(b) to mean: "(1) Any physiological disorder or condition . . . affecting one or more of the following body systems: neurological; musculo-skeletal; special sense organs . . ." According to 29 CFR § 1613.702(c) "major life activities" means, in relevant part: ". . . functions, such as . . . breathing . . ."

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